Beyond dikes and dunes

Research on management-related conditions to enhance the feasibility of the development of a more resilient coastal zone

Carolijn Becker
June 2014

Utrecht University
Master Thesis Sustainable Development

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5th of June, 2014

The cover photo was taken at Vlissingen and is the author's own material, as are all other photos unless stated otherwise.

Universiteit Utrecht

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Acknowledgements

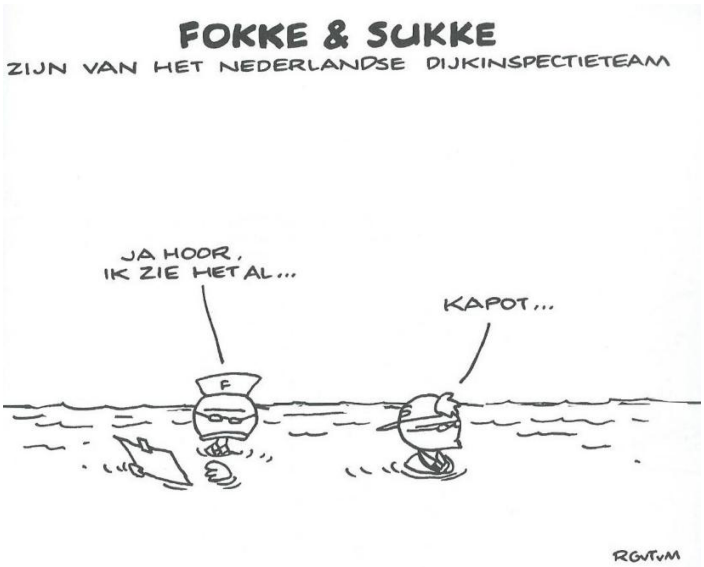
Before you lies my Master Thesis on management conditions for resilient coastal zones. Climate change and the related sea level rise and coastal management have always been an interest of mine. With this thesis I was able to deepen my knowledge and interest and hopefully contribute to finding solutions for managing the coast.

Writing a thesis can be a somewhat solitary process. However, I could not have succeeded without a couple of people. First of all, my supervisor, Carel Dieperink, who gave me enough time to finish this project and even though our meetings were always quite short, always came up with good advice and remarks. Secondly, Sabine and Stefan, who proof read the whole report and were not afraid to point out some irregularities and add improvements. Thank you!

Furthermore, I would like to thank Ben Girwar, Koen Oome, Willem Rietbroek, Leo Linnartz, Arie van Blanken, Wim de Vries, Niels Al, Stefan Aarninkhof, Arjen Boon, Lies Dekker, Andre Marinisse, Walter Vael, Sjacky Vasseur, Dr. Ir. Ronald Waterman and Bart Kornman for their time, efforts, help and enthusiastic story telling.

Also, I would like to thank the 'Zelfhulpgroep: Project experience your Thesis' for keeping me company during the starting up of the project, and especially Eefke for sticking with me until the end. Those tea breaks and strolls were very welcome. Finally, I would like to thank my parents for their special support and faith in me in the past year, but also during the rest of my studies.

Carolijn Becker
5th of June, 2014



Fokke & Sukke are part of the Dutch dike inspection team
"Of course, it's obvious..." "Broken..."
Reid, Geleijnse & Van Tol, 2008

Summary

Now that humans have inhabited coastal areas in great numbers, coastal change has become a threat to us. Therefore, we try to control or manage our coasts, sometimes successfully, but not always. However, if we want to keep society behind the dunes and dikes safe, management is needed (Nicholls et al, 2007; McGranahan, Balk & Anderson, 2007). Coastal management is an issue of international scope and importance. Therefore coastal management is stimulated by international governments and organizations such as the United Nations and the European Union (EU). The EU has developed several policies and recommendations on coastal management and Integrated Coastal Zone Management in particular (Min VWS, VROM, LNV & EZ, 2005). With more uncertain factors than before, scientist and policy makers are realising that preparing for the unknown is necessary. Part of this means developing an approach that can deal with changes and in which adaptation plays a major role. In a case where what lies ahead is uncertain it is important to be able to switch easily between strategies. This has resulted in a paradigm shift from protecting to adapting (Walker et al., 2004). A lot of research has been done already on how to manage coastal areas in the best way. There have also been many case studies in the field as to what happens in practice. However, there is still a lack of research on combining theory and practice to form policy (Nicholson-Cole & O'Riordan, 2009; Pickaver et al., 2004). This research aims to provide insights on conditions which could enhance the feasibility of the development of a more resilient coastal zone. This leads to the following research question: *Which management-related conditions make resilient coastal zones feasible?*

Coastal management

There has been a change in perspective and the main paradigm in coastal management has shifted in the last few decades to a new framework of resilience and adaptation. It requires less meddling with the environment and does not leave any infrastructure after its lifecycle ends. This is also the framework which is being used by the Dutch Coastal Delta program, which is based on the phrase 'soft where possible, hard where necessary' (Deltaprogramma Kust, 2013, p.10).

Three coastal management strategies have been explored to identify conditions for successful resilient coastal zone management. These are Integrated Coastal Zone Management (ICZM), national adaptive strategies (NAS) and Building with Nature (BwN). Conditions were retrieved from the MyCoast project (Dieperink et al., 2012), the progress indicators framework by Pickaver (2009), and papers on NAS and BwN by Biesbroek et al. (2010), Keessen et al. (2013), Van den Hoek et al. (2012) and Slobbe et al. (2012).

Methods

The research combines theoretical success conditions for coastal management with the practice of two case studies along the Dutch coastline. By interviewing stakeholders of the coastal projects insight was gained on the presence and the importance of conditions which could possibly enhance the feasibility of the development of a more resilient coastal zone in these specific locations. The case studies were conducted for the Sand Engine near The Hague and the Weak Link in Southwest Walcheren in Zeeland. For case 1, the Sand Engine, the following stakeholders were interviewed: Project bureau Sand Engine of Province of South-Holland,

Municipality of Westland, Municipality of The Hague, Ministry of Infrastructure and the Environment, Deltares, EcoShape, World Wide Fund and dr. ir. Ronald Waterman. For case 2, Southwest Walcheren the following stakeholders were interviewed: Municipality of Veere, Municipality of Vlissingen, Water board Scheldestromen, Province of Zeeland, Ministry of Infrastructure and the Environment. To verify the results of the case studies a survey was also conducted among other Weak Link projects along the Dutch coastline.

Results

When comparing the two case studies it can be noticed that the essential success conditions are practically the same; availability of financial and personal means and resources and leadership and dedication are shared by the two cases. The Sand Engine has one additional essential success condition which is public and political support. This can be explained by the fact that the Weak Links projects are set up due to necessity as the coastline needed updating to be safe. However, the Sand Engine project was not a necessary project as coastal safety had already been restored at the coast of South-Holland. This created a different situation. The public and politicians had to be convinced properly for the Sand Engine project, as acute absence of coastal safety was not an issue here. That is why public and political support was considered more important by the stakeholders.

In the survey five project managers of other coastal projects confirmed the importance of these success conditions, which implies that the results of the case studies could be relevant on a broader scale, at least in the Dutch context of coastal management.

Discussion

The results of the case studies were compared to the latest research. Ernoul & Wardell-Johnson (2013), Van Weesenbeeck et al. (2014) and Korbee et al. (2014) discuss similar cases of coastal management on Integrated Coastal Zone Management, Building with Nature and ecosystem-bases approaches to damming deltas. These three research papers show many similarities with this research on success conditions such as political support, availability of finances, stakeholder participation, stakeholder cooperation across sectors, scales and administrations, monitoring, sustainable use and added ecological value of the coastal zone (Ernoul & Wardell-Johnson, 2013; Van Weesenbeeck et al., 2014; Korbee et al., 2014). This could mean that the case studies might not be exceptions and that the identified conditions may be applicable to more coastal zone projects.

Conclusion

Comparing theory to practice led to the following conclusions. Most of the theoretical conditions were confirmed by the practice in the case studies. However, some of the conditions were not marked as important for the development of a resilient coastal zone. Noteworthy is the fact that one key condition was not identified in the theoretical framework, namely dedicated leadership. This condition was named explicitly by almost all stakeholders of both case studies and was therefore added to the refined list of success conditions. The chance that coastal management successfully contributes to more resilient coastal zones is higher if the following conditions are present:

Societal context conditions
There is a coastal management approach and plans have a long-term perspective.
The coastal zone project has strong and continuous public and political support.

Stakeholder conditions
Stakeholders are involved and can participate in the decision making process.
There is cooperation across sectors, scales and administrations.

Financial conditions
Financial and personal means and resources are available to the project team.
There is a long-term financial commitment by the stakeholders.

Process/planning conditions
There are mechanisms for monitoring, evaluation and reviewing.
The process has small and intermediate steps.

Coastal zone conditions
Monitoring shows a demonstrable trend towards a more sustainable use of coastal and marine resources and added ecological value.
There is improved protection and sustainable use of the coastal zone.

Knowledge conditions
There is development and export of (specialised) knowledge.
There is spill over of policy integration and multi-level governance to other sectors and levels.

Newly added conditions
There is dedicated leadership by a (political) representative.

A distinction has to be made between some conditions that were regarded as essential by the stakeholders and other conditions which were important for the coastal projects but not vital for the project to succeed. These essential conditions are strong and continuous public and political support; the availability of financial and personal means and resources; and dedicated leadership. These three conditions would have to be fulfilled for the success of the development of a more resilient coastal zone.

The findings in this research can be useful for policy makers and coastal managers. When knowing which conditions can help improve the management and thus the development of resilient coastal zones, this can be a great advantage. This list can be applied to coastal management projects and point out which conditions need improvement and investment. This could enhance the effectiveness of coastal zone management.

1. Introduction

On the 26th of May 2014 the Royal Netherlands Meteorological Institute (KNMI) published new scenarios on climate change (KNMI, 2014). The next day newspapers announced the weather expectations and practicalities for the next 80 years. Wetter and warmer was the message. More rain and extreme weather events. This had been concluded from a steady going trend from the most complete climate data set in the world. Another aspect of the scenarios was the sea level rise, a very relevant issue for the Netherlands as a low-lying country. How will the Netherlands deal with the effects of such prospects? Wilma Mansveld, state secretary of Infrastructure and the Environment, emphasized the urgency of the issue and the need for adaptive water management and the accompanying measures against sea level rise (Schreuder, 2014).

This publication by the KNMI demonstrates the continuous work and research that is carried out in the field of coastal and water management. It also displays how relevant this issue is for global society as these are real data and consequences that need to be dealt with today and in the future.

1.1 Problem definition: managing our coasts

As long as people have been on this planet they have had a tendency to inhabit coastal areas. These areas have much to offer to humans, a fact of which they are well aware. This is the reason that more human beings than ever are living along the coasts of each continent. In 2007 ten percent of the world's human population lived in low-lying coastal areas, and it is likely that this number has risen since then (McGranahan, Balk & Anderson, 2007). It is obvious that these coastal areas are very important to the human race, making it imperative that we protect them and their inhabitants. However, coasts can change in both predictable and unpredictable ways. They are subject to erosion, but also to human activity. A coast has many functions, such as ecology, drinking water supply, recreation, residence use and industry (Mulder, Hommes & Horstman, 2011). These functions all influence the coast and negatively affect the coasts ideal state of being.

A coast never maintains a steady form and since a couple of decades we know that climate change will create additional instability. In 2007 the IPCC concluded with very high confidence that 'coasts will be exposed to increasing risks, including coastal erosion, over coming decades due to climate change and sea-level rise' (Nicholls et al. 2007, p. 317). Climate conditions will change and therefore coastal conditions will change. This in itself is not a problem. Coasts, the ocean and weather patterns have always been subject to variability. However, now that humans have inhabited coastal areas in great numbers, coastal change has become a threat to us. Therefore, we try to control or manage our coasts, sometimes successfully, but not always. However, if we want to keep society behind the dunes and dikes safe, management is needed.

1.2 Social context: coastal management

Coastal management is an issue of international scope and importance. Therefore coastal management is stimulated by international governments and organizations such as the United Nations and the European Union (EU). The EU has developed several policies and

recommendations on coastal management and Integrated Coastal Zone Management in particular (Min VWS, VROM, LNV & EZ, 2005).
Coastal management was initiated many centuries ago. The implementation of dikes and dunes has kept the mainland dry. In the Netherlands coastal management became institutionalized very early on. As early as during the 13th century regional water boards were formed and a system of uninterrupted dikes was established (VanKoningsveld et al. 2008). This has led to a long history of coastal management and inherently to this a lot of experience in this field. Throughout the centuries human interference has increased more and more. By building dikes and the Deltaworks in Zeeland human influence on the coast has increased severely (Haasnoot & Middelkoop, 2012).

Tidal inlet at the Sand Engine

1.3 Paradigm shift: From protecting to adapting

Over the last two decades a paradigm shift has occurred in the field of coastal management. Before, there was a focus on conservation and avoiding change. The stability of the coastal area was of greater importance, basically 'the emphasis has been on protecting or shielding from change rather than on the ability to adapt to change' (Handmer & Dovers, 2008, p. 195). However, with more uncertain factors than before, scientist and policy makers are realising that preparing for the unknown is necessary. Part of this means developing an approach that can deal with changes and in which adaptation plays a major role. In a case where what lies ahead is uncertain it is important to be able to switch easily between strategies. One does not want to be tied to a certain path which allows little or no room for adaptation or flexibility. This is why resilient or adaptive coastal management has become the new paradigm. Resilience is when a system is able to 'absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks' (Walker et al., 2004, p. 1).

This shift is not only occurring in science but also in the field of policy. Reality calls for a different approach. Slobbe et al. claim that 'densely populated deltas in particular need more resilient solutions that are robust, sustainable, adaptable, multifunctional and yet economically feasible' (Slobbe et al., 2012, p. 1). This can also be found in policies on both national and international level. For example, in the Dutch Delta program adaptation and resilience are the basis for coastal management (Min IenM & EZ, 2011). But also an international program such as Eurosion proclaims resilience for coasts: 'resilience of the coast, according to EUROSION, should be promoted to facilitate the inherent ability of the coast to accommodate external changes (e.g. sea level rise and occasional human impacts), whilst maintaining the functions fulfilled by the coastal system' (Mulder, Hommes, Horstman, 2011, p.892).

1.4 Knowledge gap: linking coastal management theory to practice

So far, a lot of research has been done already on how to manage coastal areas in the best way. There have also been many case studies in the field as to what happens in practice. However, there is still a lack of research on combining theory and practice to form policy. For example, Nicholson-Cole & O'Riordan (2009) propose the implementation of key conditions but do not test this with cases in practice. Also, Pickaver et al. (2004) developed an indicator set, but do not compare it to any real-life situations. This is where there is a knowledge gap, namely on how to transfer practice and theory about resilience into policies and management strategies. How can coastal projects with a resilience perspective be made into a success by using input from coastal management theories?

1.5 Research aim & relevance

In this research an attempt will be made to support the theories on coastal management with empirical findings. By testing theoretical success conditions in the field substantiated recommendations can be made for coastal management internationally.
The objective of the research is to provide a list of success conditions for management of resilient coastal zones by:

- Designing a framework of success conditions;
- Comparing this framework to best practices in coastal management;

… for two case studies of weak links along the Dutch coastline.

This research will generate *descriptive, explanatory* and *prescriptive* knowledge on coastal management for resilient coastal zones. The goal is to form a list of recommendations that can be used internationally and will contribute to the understanding of resilient coastal management by linking theory and practices on a local level. Each coastline has its own characteristics, but on the other hand they share many characteristics. Therefore, something can be learnt from sharing coastal management practices. This is why this research is also relevant for society, as real-life situations and policy problems can benefit from the research. There is already a number of European programmes which focus on the coastal zone such as OurCoast, an Integrated Coastal Zone Management programme of the European Union and Eurosion, focusing on coastal erosion and supported by the EU. Other examples of such programmes are NatureCoast, which monitors the change in coastal zones and MyCOAST which did a project on coastal management in Bulgaria (Dieperink et al., 2012). The list of success conditions can be used in forming policies for coastal management on national, regional and

local levels and in several types of governance, whether including government, civil society or businesses.

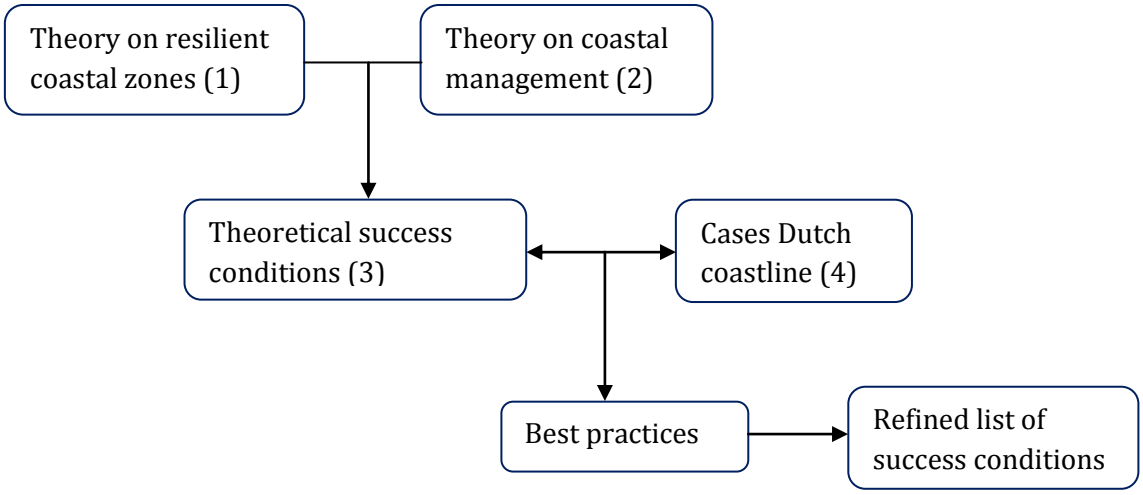
1.6 Research question and framework

In order to make recommendations for policy a central research question will be addressed in this research, which is as follows:

Which management-related conditions make resilient coastal zones feasible?

Altogether, four sub-questions will help answer the central research question and a list of conditions for resilient coastal management can be constructed to formulate recommendations for policy making. The steps that accompany each sub-question are visualised in figure 1.1. It shows how these sub-questions together form the framework to answer the central question.

Figure 1.1: Research framework



To be able to answer this central research question the research has been split into several steps and accompanying sub-questions. First of all, a theoretical background is necessary to be able to answer the central question. A literature study will be done on resilient coastal zones, a concept which has gained much influence over the last few decades in both natural and social sciences and gives an important new perspective on environmental management and coastal management in particular (Davoudi, 2012). This research is necessary to answer the first sub-question:

1. *What is a resilient coastal zone?*

The second part of the research is about another literature study which will lead to the answering of the second sub-question. This part concerns coastal management and will give more insights in its current status, the variation of paradigms and the differences and similarities on an international level.

2. *Which management conditions can improve coastal zone management?*

Thirdly, a research step is dedicated to the conditions that determine the feasibility of resilient management. In this part of the research the conditions will be specified. The research question is as follows and will lead to a set of conditions extracted from theory:

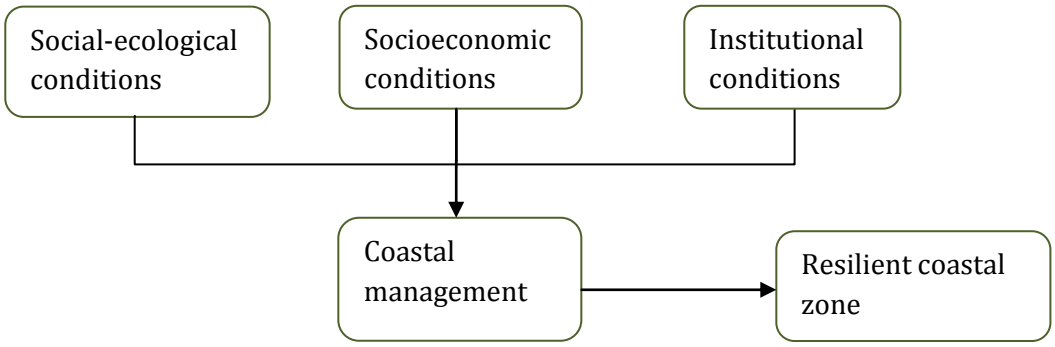
3. *Which conditions contribute to a more resilient coastal zone in theory?*

This set of conditions will then be used for answering the last sub question. This question covers two selected case studies to which the set of conditions will be applied. With policy documents and key actor interviews these two case studies will give insights in best practices and provide the empirical part of this research. For this empirical part the last sub-question is as follows:

4. Which conditions have contributed to resilient coastal zones in practice?

In the preliminary conceptual model in figure 1.2 the cause and effect relations of this research are shown. Each coastal zone has a number of conditions or characteristics which define that coast. These conditions can differ per coastal zone. When applying resilient coastal management strategies to these areas, some conditions will contribute to the success of the implementation, while others may have a negative impact on achieving resilient coastal management. 'The likelihood that an integrated area approach will produce meaningful results and contribute effectively to the resolution of complex social issues improves when several (partly overlapping and interrelated) process conditions are met' (Dieperink et al. 2012, p. 61). These conditions can influence implementation strongly and therefore it is important to know what effect they have.

Figure 1.2: Preliminary conceptual model



It can be expected that different conditions will work better on different cases, meaning that these conditions make a difference in the way that resilient coastal management is implemented and to what extent it can be feasible.

1.7 Reading guide

The next two chapters form the theoretical framework, where chapter two deals with resilient coastal zones and chapter three focuses on coastal management, after which a list of theoretical success conditions will be formulated. The methods for data collection will be discussed in chapter four. In chapter five the results of the interviews and survey will be discussed. Chapter six covers the discussion of these results and what they mean compared to the theoretical framework. The final conclusions can be found in chapter seven.

2. Resilient coastal zones

2.1 Introduction

A coast never stays the same and since a couple of decades we know that climate change will create additional instability. In this section the various characteristics of coasts will be identified. Definitions, types, functions and pressures of coasts will be covered here. Furthermore, the concept of resilience will be applied to the coastal zone. Resilience has been an upcoming term in the last decades and has changed the way we view the coastal zone. That is why, in this chapter, the following question will be answered: *What is a resilient coastal zone?*

First, the coastal zone will be defined (2.2.) and types of coastal zones will be discussed (2.3). After which various functions and pressures of the coastal zone (2.4) will be touched upon. This should give a clear vision of the coastal zone. The second part of this chapter focuses on resilience. This concept will first be defined in 2.5. Then the meaning of resilience for policy (2.6) and the coastal zone (2.7) will be discussed. In 2.8 the characteristics of a resilient coastal zone and how they can be measured will come to attention. Finally, in 2.9 the final list of characteristics of resilient coastal zones will be formulated.

2.2 Defining the coastal zone

So what defines a coast? What areas belong to it? What ecosystems need to be included when researching a coastal zone? In science a couple of different definitions have been established, which differ per field of research. But also in policy and management spheres the concept has been defined in various ways. It seems that many different perspectives can be applied.

Haslett, for example, defines the coastal zone as 'the area between the landward limit of marine influence and the seaward limit of terrestrial influence' (Haslett, 2009, p. 3). Yet, this is a very broad and general definition. This makes it easy to apply to all sorts of research and policy but also results in giving quite a vague definition with a lot of room for interpretation. The area that can be covered by this definition is much too large to really capture the coastal zone, since 'influence' can stretch a long way and might include half the continent.

However, Beatley et al. already state that 'natural systems have transient and often fuzzy boundaries' (2002, p. 13), indicating that making an exact overall definition of the coastal zone might be impossible to achieve. They provide a definition anyway which seems already less abstract than that of Haslett and it focuses more on the changeable character of coastal zones. 'Coastal regions are dynamic interface zones where land, water, and atmosphere interact in a fragile balance that is constantly being altered by natural and human influence.' (Beatley et al., 2002, p. 14). Still, it should be noted that the interconnections often go beyond the actual coastal zone.

For Beatley et al. the coastal zone consists of three parts: the backshore, the foreshore and the offshore. The backshore is the land part of the coast and includes dunes and ridges. The foreshore is the transitional area where land and water meet and the tide determines the look of

the shore. The third part is the offshore and is located into the deeper ocean (Beatley et al., 2002).

Nonetheless, each discipline has its own version of what the coastal zone consists of. For example, a marine biologist will include the sea and all the areas which are covered by the tide every so often, but a coastal geomorphologist defines this as far as coastal agents of erosion and deposition are at work, which extends the coastal zone to marine areas and even entire river catchments. Coastal ecologist might be too narrow, on the other hand, by defining the coastal zone as the area 'landward to the limits of tidal movement or the influence of salt spray on soils and vegetation' (Doody, 2001, p. 8). In practice this means that the coastal zone barely extends beyond the beach and dunes. Doody himself uses again a more change-oriented definition: 'the coastal zone is by nature indistinct, as tidal movement, storms and the effects of sea level change influence the relative position of each' (Doody, 2001, p. 9). Finally, the International Panel on Climate Change (IPCC) has, of course, formulated a definition. However, this appears to be again quite abstract and even more scientific than the formerly mentioned definitions. The IPCC states the following: 'Coasts are dynamic systems, undergoing adjustments of for process (termed morphodynamics) at different time and space scales in response to geomorphological and oceanographical factors.' (Nicholls et al., 2007, p. 318). For a scientific report that is supposed to capture the current status and essentials, also for policy makers, this is not the clearest definition, even though it is correct in basis.

It seems difficult to capture the coastal zone in an abstract definition, even though most people know what the coastal zone is when they are in it. Therefore, it can be helpful to include the diverse physical states of the coast. These include barrier islands, beaches, dunes, cliffs, tidal water, mudflats, sand flats, brackish water, wetlands, salt marshes, coral reefs, mangroves, swamps, estuaries, bays, rocky shores, deltas and lagoons (Beatley et al., 2002; Doody, 2001).

The definition that is used for this research is a combination of Beatley et al. (2002) and Doody (2001) and states the following: The coastal zone is a dynamic interface zone where land, water and atmosphere interact in a delicate balance that constantly changed by natural and human influences and which affects areas beyond the immediate coastal zone. The coastal zone exists of three parts: the backshore, foreshore and offshore and includes barrier islands, beaches, dunes, cliffs, tidal water, mudflats, sand flats, brackish water, wetlands, salt marshes, coral reefs, mangroves, swamps, estuaries, bays, rocky shores, deltas and lagoons. This definition describes the most general aspects of the coastal zone, yet is clear enough to understand what a coastal zone can be in its various forms.

2.3 Types

As there are many definitions for what a coast is or consists of, there are also many ways to categorize them. This can be done by time scale, by ecosystems, by tidal movements, by plate tectonics or by sediment types (Beatley et al. 2002; Haslett, 2009). However, most of these classifications are much too detailed and technical for the purpose of this thesis. Therefore, only a few classifications will be discussed here.

Doody differentiates between 'hard' rock coastal landscape and 'soft' coastal landscapes. This is a soil classification based on the eroding characteristics of the surface. These 'hard' rock

landscapes are characterized by low sediment availability, where the underlying geological structures are able to resist erosion. Within the 'hard' rock coastal landscapes there are high relief landscapes, like high cliffs, and low relief landscapes, like small islands and narrow rocky shores. The 'soft' coastal landscapes are more diverse and include both sedimentary and soft rock cliffs. In contrast to the 'hard' rock systems, these 'soft' systems are much dynamic and changeable as they react to more natural phenomena such as tides and storms, but also wave energy and river discharge. Examples of these coastal landscapes are estuaries, barrier islands, like the Wadden Islands, and (deltaic) coastal plains (Doody, 2001).

Haslett, on the other hand, creates his classifications based on a different natural phenomenon, namely water. Here the movement of the water is important and provides the types 'waves', 'tide' and 'river'. Wave-dominated coastal systems are among the sensitive and dynamic systems and are very prone to change when human influence is present. The characteristics of a wave-dominated system is determined by wind speed and wind duration and the size of the ocean it is located at. All this determines the wave pattern and the storm intensity along the coast. This variety of characteristics leads to a number to different coasts, such as wind waves systems, tsunami wave systems, cliffs, shore platforms, rocky shores, coral reefs, coral cays, barrier islands and, of course, beaches and sand dune systems. The second category is that of tide-dominated coastal systems. This type has less variety than the wave-dominated category and includes estuaries, salt marshes and mangroves. It is also less common, however, these systems 'support a disproportionate level of global human population.' (Haslett, 2009, p.71). Finally, Haslett identifies the river-dominated coastal systems, which consists of one specific coastal system; the delta. The most important characteristic of these systems is that they get their water and sediment input from rivers. Furthermore, delta are very varied and can contain a number of the before mentioned coastal systems (Haslett, 2009).

Another way to look at types of coasts is that of Beatley et al. (2002). They categorize by coastal ecosystems, which in practice seems to be very similar to the approach of Haslett (2009). They also distinguish barrier islands based on dunes, beaches and inlets; estuaries; coastal marshes divided in salt, brackish, intermediate and freshwater marshes; coral reefs; and rocky shores and bluffs (Beatley et al., 2002).

All these different types of coastal systems do however require a different approach as some change fast and suddenly whereas others are slow and steady (Doody, 2001).

2.4 Functions & pressures

For humans the coastal zone is very important; over half of the world population already lives there and uses it in many different ways (Haslett, 2009). Some of these functions are more harmful than others, but they all influence the coastal zone. We can identify industrial use, residential use, resource exploitation, protection against flooding, ecological use and conservation, infrastructure, economical use, drinking water supply and recreation. Currently, 23% of the world's population lives in an area which is within 100 km from the coastline and below the 100 meters above sea level mark (Nicholls et al., 2007). This means that there is a very high population density along the coast, which puts a lot of pressure on the coastal zone. It leads to a 'disproportionately rapid expansion of economic activity, settlements, urban centres and tourist resorts' (Nicholls et al., 2007, p. 319). This holds for both developed and developing

countries, meaning that this is a global phenomenon which does not belong to a certain degree of economic or political development.

These population densities and their usage of the coasts puts a lot of pressure on the coastal zone. We can divide these pressures into nature-related pressures and human-related pressures. Nature-related pressures have always been part of coastal ecosystems; they are wind, waves, currents, tides, hurricanes, extra tropical storms, sea level change, erosion and accretion (Beatley et al., 2002). These are the kind of pressures that continue without human influence and shape the coasts in their natural form. Some of these pressures are very short-term, like cyclones, typhoons and tsunamis, while others are more long-term, like the wave activity and sea level change (Haslett, 2009). These phenomena change the coastal zone, but can only be perceived as a coastal hazard when humans are affected by them, because humans experience these changes as negative. It can be very difficult to predict these changes as each coast reacts in another way to these natural changes (Nicholls et al., 2007).

Human-related pressures are all human activities that affect the coastal zone in some way. During the 20th century the use of the coasts by humans has become much more intense (Nicholls et al., 2007). The coast is now used for infrastructure, industrial activities and urban expansion. Resource exploitation also affects the coast by overfishing the stocks, mangrove deforestation and mining the oil and gas reserves off the coast. The infrastructure that is needed for all these economic and urban activities is also putting pressure on the coastal zone. In the last century many ports have been created for shipping, which have to be connected to the mainland by roads and bridges. Wetlands have been reclaimed for more space and even artificial lands have been constructed, like the Second Meuse Plain at Rotterdam and the Palm Islands project in Dubai. An activity that seems harmless but which can do a lot of damage is tourism and recreation. With so many people visiting the natural areas along the coast, degradation is likely. Dunes are subject to erosion caused by heavily used cliff paths, sea vegetation and soils are damages by boats and artificial marinas create sediment changes which can be very harmful. Even coastal towns can suffer from the overexposure to tourism (Beatley et al., 2002; European Environmental Agency, 2006). All these human activities lead to the degradation of coastal ecosystems and this can have severe consequences, such as shoreline retreat and a higher of flooding in, for example, Thailand, Vietnam and the USA. Rapid urbanisation can lead to the enlargement of natural coastal inlets and salt water intrusion by pipelines. Other consequences are waste disposal into ocean waters, like fertilisers and contaminants, but also ordinary sewage water. Even the retrieval of energy from water resources can be a problem, as the dams upstream can cause severe changes in sediment and erosion patterns, which can lead to a changing ecosystem (Nicholls et al., 2007).

It is important to realize that not just the type of activities can be harmful to the coastal zone, but also the scale in which they are carried out. The population at the coasts keeps increasing, which means that all the accompanying activities will increase as well. That means that the appearances of the coasts will change at a rapid pace. 'Human pressure on coastal resources can compromise ecosystem integrity' (European Environmental Agency, 2006, p. 12). This makes the coast very vulnerable, but it is also the human population that lives there that is vulnerable to the possible threats (Harvey & Nicholls, 2008).

These first three sections have provided a better understanding of the coastal zone. However, the sub question for this chapter is about resilient coastal zones. Therefore, the next couple of sections will look into the concept of resilience before combining the two together and answering the question: *What is a resilient coastal zone?* Resilience can be applied to many subjects, however, here resilience is meant as the functioning of the coastal zone itself, the natural area at the shore.

2.5 Defining resilience

Resilience is a concept originating from the 1960s and was defined by C.S. Holling, an ecologist. He defined the concept as follows: 'resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist' (Holling, 1973, p. 17). This is a very abstract definition which has an almost mathematical sense to it. However, when breaking it down, it seems that resilience is about the strength of relationships and structures and coping mechanism of a system when major changes occur. Handmer & Dovers phrase it as follows: 'it is about how a system copes with major perturbations to its operating environment' (Handmer & Dovers, 2009, p. 190).

Yet, it is not just coping with the changes; resilience tells us something about whether the system is able to return to its original state. What matters is whether the system is able to 'absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks' (Walker et al., 2004, p. 1). What is meant here is that the system does not have to be exactly the same as before, but it does need to retain its primary features and functions. Resilience is what makes the system absorb shocks up to a certain threshold, but still maintain its functions (Folke, 2006).

One of the most complete definitions is that of Adger et al., they state that 'resilience reflects the degree to which a complex adaptive system is capable of self-organization (versus lack of organization or organization forced by external factors) and the degree to which the system can build capacity for learning and adaptation' (Adger et al., 2005, p. 1036). This definition implies the importance of the system's ability to recover itself. Even though the system is connected to other systems and influenced by external factors, it is able to manage itself and adapt to the circumstances when necessary.

Resilience can be broken down to a few aspects. Walker et al. have identified four aspects which are important for this concept. Together these aspects determine the degree of resilience, where each aspect has a different effect on this degree. Every one of these aspects can also be influenced by individuals in the system or the system as a whole. This collective capacity to change or manage the resilience of the system 'determines whether they can successfully avoid crossing into an undesirable system regime, or succeed in crossing back into a desirable one' (Walker et al., 2004, p. 3). These changes can be either intentional or unintentional and therefore may not always be positive, if we are unaware of them at first.

Resilience = latitude + resistance + precariousness + panarchy

First of all, there is latitude; this is 'the maximum amount a system can be changed before losing its ability to recover' (Walker et al., 2004, p. 2). When such a threshold is crossed, recovery is very difficult or impossible. In case one wants to alter the latitude one needs to move the threshold away from or closer to the current state of the system.
Secondly, the aspect of resistance can be added to the picture. Resistance can be viewed as the 'ease or difficulty of changing the system' (Walker et al., 2004, p.3). In other words, how easily the system resists to being changed. When one wants to alter the resistance, one needs to make the thresholds of no recovery more easy or difficult to reach. This can be done by speeding up or slowing down processes or creating or removing obstacles.

Third, there is precariousness which can be described as the closeness of the current state of the system to a threshold. In other words: how far away the system is from switching to another equilibrium or steady state. Precariousness can be changed by moving the current state of the system towards or away from this threshold.

Fourth, there is panarchy. About this aspect Walker et al. say the following: 'because of cross-scale interactions, the resilience of a system at a particular focal scale will depend on the influence from states and dynamics at scales above and below' (Walker et al., 2004, p. 2). Local changes can be triggered by regional or even global shifts. To change this aspect of resilience one needs to manage the cross-scale interactions to avoid or create the loss of resilience at the largest and most socially catastrophic scales (Walker et al., 2004).

These four aspects show that resilience can be altered in various ways. Altogether these aspects and the ways to change form the adaptability of the system, which is 'the capacity of actors in a system to influence resilience' (Walker et al., 2004, p. 3). Adaptability is what gives the system and its actors influence on the state in which the system is. Something which is the opposite of this adaptability is vulnerability which can be defined as 'susceptibility to injury' (Handmer & Dovers, 2008, p. 190). When a system is vulnerable it is not able to resist drivers and processes from in and outside the system and is therefore more prone to change and thus less resilient. The more resilient the system is, the less vulnerable it is (Walker et al., 2004; Handmer & Dovers, 2008).

2.6 Resilience in policy

Since two decades the resilience concept is also being used in policy making and it has created a shift in thinking perspectives. 'The concept of resilience is a profound shift in traditional perspectives, which attempt to control changes in systems that are assumed to be stable, to a more realistic viewpoint aimed at sustaining and enhancing the capacity of social-ecological systems to adapt to uncertainty and surprise.' (Adger et al., 2005, p. 1036). Before this paradigm shift the natural world was viewed as a static and regulated system which could be controlled once this system was understood. However, many scientist see this differently now and view the natural world as an ever-changing, complex and unpredictable place (Davoudi, 2012). With this changed perspective comes a whole different way of policy making. Instead of protecting or shielding from change the emphasis should be on the ability to adapt to change (Handmer & Dovers, 2008). This means that the focus needs to be on different capacities, like resilience. Ecosystems need to be able to bounce back to their current system or smoothly switch into another acceptable state of functioning.

Both Gunderson (2000) and Handmer & Dovers (2008) have identified 3 different ways of combining ecosystem management and resilience. For Gunderson the first way is to let the system be and wait until it returns to its original state without intervention. The second option is to actively manage the system back into the desirable state. And then there is the third way which is to accept the change and adapt to the new system. For Handmer & Dovers the types are slightly different as they start with 'resistance and maintenance', a management approach which focused more on conservation. Conservation can be a good approach; however, sometimes it can have contradictory effects on the ecosystem (Beatley et al., 2009). It could be compared to the first way of Gunderson, but requires a more active approach and is therefore more like his second option of actively keeping or bringing back the system to its original state. The second type of Handmer & Dovers is that of 'change at the margins' which allows for some change and adaptation in the system but only up to certain extent. A complete switch to a different system is still not desirable here. This type can be placed between the second and third way of Gunderson. Finally, there is the type of 'openness and adaptability' which is an approach which embraces the changing between systems and adapting to the circumstances, whatever they may be (Gunderson, 2000; Handmer & Dovers, 2008).

In policy this difference in perspective can be characterized as a reactive versus proactive approach. Where the reactive approach is passive until action is necessary, the proactive approach looks ahead and tries to adapt to the changes as soon as possible. This proactive approach can be an advantage and is a possibility for social systems in contrast to ecosystems as there is a 'major difference between ecosystems and societies: the human capacity for anticipation and learning' (Klein et al., 2003, p. 39). However, one cannot easily just implement resilience into social or social-ecological systems (SES). When dealing with social system a number of issues need to be taken into account. First of all, humans have the ability to change the adaptive cycles. This can be both positive and negative, as it means that we are able to influence these patterns, but this also means that we able to harm them. Then, there are a few normative questions that need answering, like resilience of what to what? What should be included? What is beyond our system? Resilience to for which purpose? What do we want to achieve with it? When it comes to social systems these questions are what makes the difference between social science and natural science. These questions imply that there will be consequences in both positive and negative ways. Furthermore, in ecology the concept of resilience is power-blind and a-political. However, this is not the case in the social science and society in general. There are punishments and rewards, certain actors benefit and other experience losses. This raises questions of fairness and justice (Davoudi, 2012). Who should benefit? Who should pay? In natural science these questions are not an issue.

Yet, it is necessary to include resilience in policy making as it has much potential and can increase management possibilities. 'It is argued that managing for resilience enhances the likelihood of sustaining desirable pathways for development in changing environments where the future is unpredictable and surprise is likely.' (Folke, 2006, p. 254). With managing for resilience the adaptive capacity can be increased which will make it possible to keep our options open and avoid path-dependency and lock-ins into certain undesirable pathways. It is a way to deal with uncertainty (Walker et al., 2004). And this is necessary as we 'face more variable environments with greater uncertainty about how ecosystems will respond to inevitable increases in levels of human use' (Folke et al., 2004, p. 558).

2.7 Resilience & coastal zones

As mentioned above, resilience can be linked to planning and policy making. This can be used for all sorts of purposes but resilience is most often used in planning for natural hazards and ecosystems. 'Applied to the context of climate change, resilience is the capacity of an individual, community or institution to dynamically and effectively respond to shifting climate circumstances while continuing to function at an acceptable level' (Brown et al., 2013, p. 535). In this research the focus is on coastal zones which are very reliant on resilience for their continuity. Coastal zones are always influenced by many different forces, both natural and human. Forces which can affect the resilience of such a coastal system. 'Hazards in coastal areas often become disasters through the erosion of resilience, driven by environmental change and by human action.' (Adger et al., 2005, p. 1036-7).

Of course, as has been explained earlier on in this chapter, coastal zones are always subject to change. However, it is important that they have enough strength and resilience to work with this change, whether that results into bouncing back into the old state or switching into another state. 'Many coasts undergo continual adjustment towards a dynamic equilibrium, often adopting different 'states' in response to varying wave energy and sediment supply' (Nicholls et al., 2007, p. 318). Or as Klein et al. put it: 'perturbations are not isolated events from which a coastal system may or may not recover, but are ever-present and occur at different temporal and spatial scales' (Klein et al., 2003, p. 40). Change is always a factor for most ecosystems and especially coastal ecosystems which experience tides and storms on a daily basis. This is what make coastal ecosystems resilient to many pressures and changes, these systems can easily bounce back or switch to a different state that will better for the new circumstances. 'Natural ecosystems have proved to be key in increasing coastal resilience and protecting the coast during hurricane episodes. Coastal wetlands, coastal dunes and beaches, inter-tidal flats, coastal forests etc. are the most effective defences in the case of these types of natural disasters' (EEA, 2006, p. 9).

2.8 Indicators for resilience

After having discussed what the concept of resilience is and what it means in both science and policy, it is also necessary to have good indicators for a resilient coastal zone in order to perform research on it. That way it is possible to measure resilience in coastal zones and identify which factors influence resilience. For this research the focus will be on coastal resilience and the resilience in coastal zones.

There are several ways to measure the resilience in an ecosystem. Often, it is measured by keeping track of the abundances of a few conspicuous species. However, there is a weakness to this approach, as 'the mechanisms driving temporal or spatial variation in abundance are often poorly known, and the consequences of change in these few species to the ecosystem as a whole are rarely considered' (Hughes et al., 2005, p.4). This approach focuses too much on just a few elements of the system and therefore ignores the bigger picture, while resilience in ecosystems is much broader than just a few single species. An ecosystem does not function on its own; it is strongly related to other systems bigger and smaller than itself. Therefore, scale is an issue here and it is important to state at which level of scale the system is analysed. To get a better overview Klein et al. (1998) argue to analyse at the ecosystem or meta-ecosystem level instead of the species level. This way observations get to be made properly and it may show that 'the

degradation of one ecosystem (possibly associated with increasing morphological coastal dynamics) may be compensated by the development or improvement of another ecosystem elsewhere' (Klein et al., 1998, p. 262).

Williams et al. (2001) discuss two variations on a resilience checklist, the 'main root checklist' and the 'GAVAM checklist'. These checklists have been designed to monitor resilience in coastal areas and specifically dunes. The outcome of the checklists consists of a Vulnerability Index for the main root checklist or the Coastal Dune Vulnerability Index (DVI) for the GAVAM checklist, indicating the 'loss of capacity of a dune system to return to its original dynamic equilibrium after system displacement' (Williams et al., 2001, p. 1940). Vulnerability is a concept opposite of resilience. When a system is vulnerable it is not resilient and vice versa. Both concepts refer to a certain capacity to adapt to and deal with changes. 'Vulnerability is most often conceptualized as being constituted by components that include exposure to perturbations or external stresses, sensitivity to perturbation, and the capacity to adapt' (Gallopin, 2006, p. 294). Klein et al. defined vulnerability just as the IPCC did: 'the degree of incapability to cope with the consequences of climate change and accelerated sea-level rise' (Klein et al., 1998, p. 260). This way the Vulnerability Index can be used as a measure for resilience.

The first checklist is the Main Root Checklist consists of six categories which are all build up from a number of parameters. The first five categories (A-E) form the Vulnerability Index, which is then divided by the sixth category (PM). This results in the ratio VI/PM (Williams et al., 2001).

Main root checklist:

1. (A) Site and dune morphology (8 parameters)
2. (B) Beach condition (9 parameters)
3. (C) Surface character of the seaward 200 meters (12 parameters)
4. (D) Pressure of use (14 parameters)
5. (E) Vegetation (11 parameters)
   - VI = A + B + C + D + E
6. (PM) Protection measures (11 parameters)

The VI/PM ratio indicates the status of the dunes. If the ratio is lower than 0.8 the system is in a positive/negative phase which means the system is changing either from or towards equilibrium. When the system is between 0.8 and 1.3, the dunes are in equilibrium and above 1.3 the system is in a positive/negative phase again. This ratio can be used 'to monitor a system through time or to compare systems regionally' (Williams et al., 2001, p. 1939).

The second checklist is the GAVAM checklist, where the abbreviation stands for Geomorphological, Aeolian, Vegetation, Anthropocentric and Marine influences. This checklist has five categories and results in the DVI ratio by dividing the sum of the five categories by five.

GAVAM checklist:

1. (GCD) Geomorphological condition of the dune system (8 parameters)
2. (AI) Aeolian influence (9 parameters)
3. (VC) Vegetation condition (10 parameters)
4. (A) Anthropocentric/(HE) Human effects (17 parameters)
5. (MI) Marine influence (8 parameters)

- DVI ratio = (GCD + AI + VC + HE + MI)/5

The geomorphological condition can be analysed by using parameters such as typology, extent of the coastal dunes, which includes length, width and height as well as particle size. The Aeolian influence depends on the available sand budget. The vegetation conditions influence the morphology of the dunes. There are three types of vegetation which determine these conditions: 1. winter annuals, small-sized, soft-leaved and prone to wave erosion. This type does not have any presumed adaptations to the dune environment; 2. perennials, below-ground roots, the leaves are adapted to coastal environmental stress; 3. capable of being spread by sea-water, can withstand burial. Anthropocentric or human effects can be split between temporary and permanent effects for the dunes. Temporary includes pedestrians, vehicles and animal trampling; permanent are roads, housing, parking, crops and forestry. Human activities that affect the coastal dunes are agriculture, grazing, mineral extraction, military training, urbanisation, industry, airports and recreation. Parameters for marine influence include wave parameters, tidal range, coastal orientation, beach slope and grain particle size (Williams et al., 2001).

The Coastal Dune Vulnerability Index (DVI) is calculated by summing up the five categories and dividing the number by five. This will present a ratio which indicates the vulnerability of the dunes. Based on the DVI ratio dunes can be categorized in four groups. If the ratio is lower than 0.25 the dune ecosystem is in Group I and has a low vulnerability. Between 0.25-0.5 the dunes belong in Group II which indicates a low to medium vulnerability. Group III ranges from 0.5 to 0.6 and means medium to high vulnerability. Lastly, any ratio above 0.6 is categorized in Group IV and has a high vulnerability (Williams et al., 2001). The DVI looks at both natural and human environmental changes and identifies the main source of vulnerability. Williams et al. (2001) state that keeping human activities away from the coastal beaches will decrease vulnerability. Human activities seem to have a great influence on the state of the dune ecosystems.

Checklists such as the Main root checklist and the GAVAM checklist make it possible to compare dune ecosystems. 'The checklist enables spatial comparisons to be achieved, and repeated application of the procedure at specific sites would generate useful information on temporal changes.' (Williams et al., 2001, p. 1954). By applying the checklists dune systems can be monitored properly. This way subtle change can be identified more easily which will improve the long-term survival of the ecosystem and make managing the system a better understood task (Williams et al., 2001). 'The consequences for management are profound: it is easier to sustain a resilient ecosystem than to repair it after a phase shift has occurred' (Hughes et al., 2005, p. 3). Fujita et al. have identified such transitions and which attributes are important for the level of resilience. These are ecological redundancy, species complementarity, intra-species complementarity, and higher productivity and recruitment rates (Fujita et al., 2013, p. 540).

Williams et al. (2001) point out that the coastal dune ecosystems are quite vulnerable, due to low resilience levels. Coastal exposure and restricted sand supply can then lead to potential erosion, which recreates a vulnerable coast. When a coast is not resilient, it does not have the capacity to recover from forceful natural events, such a storms and strong tides.

2.9 Conclusion

This chapter dealt with the following sub question: *What is a resilient coastal zone?* In this final section we will recapture and answer the question.

The definition that is used for this research is a combination of Beatley et al. (2002) and Doody (2001) and states the following: The coastal zone is a dynamic interface zone where land, water and atmosphere interact in a delicate balance that constantly changed by natural and human influences and which affects areas beyond the immediate coastal zone. The coastal zone exists of three parts: the backshore, foreshore and offshore and includes barrier islands, beaches, dunes, cliffs, tidal water, mudflats, sand flats, brackish water, wetlands, salt marshes, coral reefs, mangroves, swamps, estuaries, bays, rocky shores, deltas and lagoons. This definition describes the most general aspects of the coastal zone, yet is clear enough to understand what a coastal zone can be in its various forms.

A resilient coastal zone is a coastal zone which is able to cope with major changes, through both internal and external forces. Whether the coastal zone is able to return to its original state depends on the level of resilience. A resilient coast can handle major pertubations and still recover to more or less the coastal zone it was before (Handmer & Dovers, 2009, p.190). Additionally, the coastal zone should 'retain essentially the same function, structure, identity, and feedbacks' (Walker et al., 2004, p.1). Adger et al. (2005) emphasize that the coastal zone is able to recover itself and adapt to the new circumstances.

Characteristics of a resilient coastal zone:

- Dynamic zones where land, water and atmosphere interact (Haslett, 2009; Beatley et al., 2002)
- Transient and fuzzy boundaries (Beatley et al., 2002)
- Coping with major changes, both internal and external (Holling, 1973; Handmer & Dovers, 2009; Folke, 2006; Walker et al., 2004)
- Able to recover itself to its original state (Holling, 1973; Klein et al., 2003)
- Able to adapt to new circumstances (Holling; Adger et al., 2005; Walker et al., 2004; Gallopin)

3. Coastal management

3.1 Introduction

As discussed in the former chapter, coastal zones are very important to humans. Therefore, it is only logical that we wish to manage them and change or sustain them in a way which suits our needs. This has led to various ways of coastal management and several strategies to do so. This management process is being performed at many different scales; international, national, regional and local (Beatley et al., 2002). In this chapter various management types will be discussed and will provide us with management conditions for coastal management, so we can answer the next sub-question: *Which management conditions can improve coastal zone management?*

First, the recent paradigm shift in coastal management will be discussed in 3.2. After this three management strategies and their features will be discussed. These are Integrated Coastal Zone Management (ICZM) in 3.3, National Adaptation Strategies (NAS) in 3.4 and Building With Nature (BwN)in 3.5. These three management strategies all present some conditions for the success of their particular approach. These conditions are identified and incorporated into one list of theoretical success conditions for coastal management (3.6).

3.2 A paradigm shift towards resilience and adaptation

Coastal management is a tool that people have been using for centuries already, to protect themselves and their habitat from flooding and other coastal hazards. But also the activity of humans themselves affect the coast and therefore the coastal zone needs to be managed. 'The aims of coastal management are to facilitate the human use of the coastal zone, but minimise the impacts of such human use, and to protect human interests at the coast from natural and human-related processes' (Haslett, 2009, p. 155). Ultimately, these should lead to sustainable coastal management, which is non-destructive and values renewable resources. This requires a long-term perspective and a responsibility towards other generations, other places and other species (Haslett, 2009). Yet, coastal management is a complex issue and was quite fragmented for a long time. 'Early policies affecting the coastal zone were predominantly issue oriented (e.g. water quality) and reactive in nature. Furthermore, the governance of coastal and marine areas has remained fragmented between countries and thematic areas (e.g. sectors) at both national and European level' (EEA, 2006, p.75).

However, recently there has been a change in perspective and the main paradigm in coastal management has shifted in the last few decades to a new framework of resilience and adaptation. Before there was a strategy of resistance, also known as 'hard' engineering, which resulted in concrete structures such as dikes and other inflexible infrastructure along the coast. The water was seen as something that needed to be battled, not as a feature one could work with. 'But 'hard' engineering approaches like dams, storm surge barriers and defensive coastal maintenance strategies may well, in the long run, increase rather than reduce the vulnerability of the societies they are supposed to protect. There is a need to develop more sustainable coastal protection infrastructures.' (Slobbe et al. 2012, p. 3). Nowadays, many favour the resilience strategy or 'soft' engineering. 'Soft' engineering is regarded as more sustainable. It

requires less meddling with the environment, does not leave any infrastructure after its lifecycle ends. This is also the framework being used by the Dutch Coastal Delta program, which use the phrase 'soft where possible, hard where necessary' (Deltaprogramma Kust, 2013, p.10) as a guidelines for their plans. This resilience strategy is part of adaptive management which is defined by the IPCC in the Third Assessment Report as 'adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities' (McCarthy et al., 2001, p. 982).

This paradigm shift has resulted in new policies and management strategies. The European Environmental Agency has come across three important issues in these policies: 'the importance of land/sea interaction; the human dimension in coastal processes; and the need to integrate different sectors and stakeholders in order to avoid the type of conflict which leads to unsustainable development' (EEA, 2006, p.75). A flexible and problem-oriented response is needed to adapt to local circumstances and issues as each coastal zones has its own diverse physical, economic, cultural and institutional characteristics dynamics (EEA, 2006). 'Densely populated deltas in particular need more resilient solutions that are robust, sustainable, adaptable, multifunctional and yet economically feasible' (Slobbe et al. 2012, p.1). Hallegatte (2009) distinguishes five kinds of strategies in this new paradigm: no-regret strategies; reversible strategies; safety margin strategies; soft strategies; and strategies that reduce decision-making time horizons.

3.3 Integrated Coastal Zone Management

One form of coastal management is Integrated Coastal Zone Management (ICZM). ICZM explicitly focuses on the integration of the several sectors that are involved in the coastal zone. This way a holistic approach is created and all aspects of the coastal zone are taken into account. It is an ecosystem-based approach, which respects the limits of natural resources and the ecosystems. This approach should lead to a more efficient use of the coastal resources and sustainable development of the coastal zone. Coordination of the different policy fields affecting the coastal zone is important in this approach (European Commission, 2013). Within the European Union several local, regional and (inter)national initiatives and programmes with an ICZM perspective have been set up to protect the coastal environment (Shipman & Stojanovic, 2007). Most of these projects are connected through OURCOAST, an EU-project which supports and facilitates the sharing of experiences and best practices in coastal management in Europe. The intention is to learn from other projects and take the knowledge along into future policies as ICZM is a long-term form of management. ICZM covers the complete cycle of coastal management; starting with data collection, then planning, decision-making, and finally project management and monitoring of the implementation (European Commission, 2013). 'It reiterates the need for a strategic approach to the management of the coastal zone which is underpinned by a number of important principles such as the eco-system approach, the precautionary principle and adaptive management.' (Pickaver et al., 2004, p. 450).

The European Union started applying ICZM after the UN Earth Summit of Rio de Janeiro in 1992. With Agenda 21 this was the kick-start for ICZM on a European level (European Commission, 2013). Europe has a lot of coastal zones, of which 15,100 kilometres has been retreating, causing many problems in these areas (European Commission, 2004). This has resulted in setting many local, regional and international projects and pilots. However, the results of these are very mixed. While some nations and regions seem to have picked up ICZM very well, like the

United Kingdom and the Netherlands, others struggle with continuing the program and resort to ad hoc decision making on coastal issues. An important reason for this is the fact that EU funding has been ended and countries have been left on their own to implement the program. This has led to much fragmentation of ICZM in Europe and results in an inconsistent program (Shipman & Stojanovic, 2007).

A couple of issues come to the surface in the paper of Shipman & Stojanovic (2007), which they have detected in the United Kingdom, which is one of the countries that has implemented ICZM quite well already. First of all, there is a complexity of responsibilities. Due to sectoral management there is no clarity on who is responsible for the coastal zone and its management. Second of all, there is often no framework for the coordination of implementing ICZM. Policies are criticised for a rather prescriptive and functional approach, meaning that it does mention the desired results but not how to get there. Thirdly, an information gap prevents the connection between collected data for coastal research and the real needs of the coastal community. This leads to miscommunication and a lack of interaction between the administrative and diverse sectoral layers in government. Fourth, local communities seem to have very little influence on the global perspective for coastal management. As there is 'little or no strategic or integrated planning of resource use' (Shipman & Stojanovic, 2007, p. 382), coastal communities are concerned about coastal activities that may influence their direct environment. Lastly, there is change in coastal management at EU and national level, barely anything has changed at the local level (Shipman & Stojanovic, 2007). This research shows that even though ICZM is being implemented all over the European Union, there are still hurdles to be taken and issues to be dealt with.

However, many researchers have taken it upon themselves to identify the tools and indications for good ICZM. Among them are Alan Pickaver (2009) and Dieperink, Boesten, Hovens & Tonkes (2012), who have formulated lists of progress indicators and success conditions. Pickaver (2009) has listed 31 progress indicators for ICZM and categorised them into four phases of progress (See table 3.1). These phases range from only a few aspects of general coastal management and planning to a complete and functioning framework of ICZM which has resulted in 'an efficient, adaptive and integrative process [that] is embedded at all levels of governance and is delivering greater sustainable use of the coast' (Pickaver, 2009, p.72). As the fourth and final phase is the desired destination, these seven progress indicators represent a completely functioning ICZM strategy. This means that the ICZM process is properly supported by politics; that cooperation across coastal and marine boundaries the normal routine; the coastal zone is assessed with a comprehensive set of coastal and marine indicators to work towards a more sustainable coastal zone; there is a long-term financial commitment by the stakeholders; end users of the coastal zone are well informed to be able to make coherent and well-crafted decisions on time; governance ensures mechanisms for reviewing and evaluating the progress of implementation; and monitoring results show a trend towards more sustainable use of coastal and marine resources (Pickaver, 2009).

Table 3.1 Progress indicators by Pickaver (2009)

	Aspects of coastal planning and management are in place
1	Decisions about planning and managing the coast are governed by general legal instruments.
2	Sectoral stakeholders meet on an ad hoc basis to discuss specific coastal and marine issues.
3	There are spatial development plans which include the coastal zone but do not treat it as a distinct and separate entity.
4	Aspects of the coastal zone, including marine areas, are regularly monitored.
5	Planning on the coast includes the statutory protection of natural areas.
	A framework exists for taking ICZM forward
6	Existing instruments are being adapted and combined to deal with coastal planning and management issues.
7	Adequate funding is usually available for undertaking actions on the coast.
8	A stock take of the coast (identifying who does what, where and how) has been carried out.
9	There is a formal mechanism whereby stakeholders meet regularly to discuss a range of coastal and marine issues.
10	Ad hoc actions on the coast are being carried out that include recognisable elements of ICZM.
11	A sustainable development strategy which includes specific references to coasts and seas is in place.
12	Guidelines have been produced by national, regional or local governments which advise planning authorities on appropriate uses of the coastal zone.
	Most aspects of an ICZM approach to planning and managing the coast are in place and functioning reasonably well
13	All relevant parties concerned in the ICZM decision-making process have been identified and are involved.
14	A report on the state of the coast has been written with the intention of repeating the exercise every 5 or 10 years.
15	There is a statutory coastal zone management plan.
16	Strategic environmental assessments are used commonly to examine policies, strategies and plans for the coastal zone.
17	A non-statutory coastal zone management strategy has been drawn up and an action plan is being implemented.
18	There are open channels of communication between those responsible for the coast at all levels of government.
19	Each administrative level has at least one member of staff whose sole responsibility is ICZM.
20	Statutory development plans span the interface between land and sea.
21	Spatial planning of sea areas is required by law.
22	A properly staffed and properly funded partnership of coastal and marine stakeholders is in place.
23	ICZM partnerships are consulted routinely about proposals to do with the coastal zone.
24	Adequate mechanisms are in place to allow coastal communities to take a participative role in ICZM decisions.
	An efficient, adaptive and integrative process is embedded at all levels of governance and is delivering greater sustainable use of the coast

25	There is strong, constant and effective political support for the ICZM process.
26	There is routine (rather than occasional) cooperation across coastal and marine boundaries.
27	A comprehensive set of coastal and marine indicators is being used to assess progress towards a more sustainable situation.
28	A long-term financial commitment is in place for the implementation of ICZM.
29	End users have access to as much information of sufficient quality as they need to make timely, coherent and well-crafted decisions.
30	Mechanisms for reviewing and evaluating progress in implementing ICZM are embedded in governance.
31	Monitoring shows a demonstrable trend towards a more sustainable use of coastal and marine resources.

(Pickaver, 2009, p. 71-72)

The other list of success conditions has been formed by Dieperink, Boesten, Hovens & Tonkes (2012) and was used to assess a number of projects of MyCoast in Bulgaria. This list consists of 15 conditions and covers the behaviour of the stakeholders, the negotiation process and the necessary means to achieve a good result. 'Ideally, application of the integrated area approach should result in linked intellectual and organizational capacities of all stakeholders, an enriched process and more broadly accepted plans, which generate mutually supportive and feasible actions' (Dieperink et al., 2012, p. 61). Yet, to come to such a situation of good governance, coordination, monitoring and accountability are needed. 'The likelihood that an integrated area approach will produce meaningful results and contribute effectively to the resolution of complex social issues improves when several (partly overlapping and interrelated) process conditions are met' (Dieperink et al. 2012, p. 61). Firstly, good governance leads to projects that bring stakeholders together, ensures good communication among them and gives room to create ideas. Secondly, coordination can make different disciplines and sectors come together and cooperate. Third of all, monitoring is necessary to safeguard the content and the legal, financial and administrative issues. Lastly, accountability ensures that all stakeholders feel responsible for the process and all steps of the process are taken seriously (Dieperink et al. 2012).

Success conditions from the MyCoast Project:

- Important stakeholders perceive a situation as undesirable; there should be a shared sense of urgency in society to improve the quality of an area.
- Those stakeholders who are absolutely indispensable in making strategic decisions and implementing policies are willing to participate.
- Stakeholders with similar backgrounds and representing similar interests should be organized and speak with one voice.
- Stakeholders should (be able to) respect each other's opinions and commitment.
- Stakeholders have insight into mutual inter-dependencies and take major dependency relations between public and private actors into account.
- Stakeholders should be able to incorporate new knowledge and views.
- Stakeholders have a clear image of the role they have to play.
- Participants must be willing to negotiate with each other: they must have enough scope to defend their own interests, but are also willing to consider new ideas and solutions.

- Participants should have flexible mandates from their constituencies and the representatives should have authority within their stakeholders' community.
- The process should be transparent (at least within the stakeholders' community) and clearly documented.
- Intermediate and small step results should be emphasized to show the added value of the approach and act as a catalyst for next steps.
- The results are accepted in formal political decision-making processes.
- Process results can be formalized using existing legal instruments.
- Personal and financial means are made available to organize and to participate in the process; stakeholders are willing and able to organize or host meetings, put forward discussion topics and time schedules.
- Apart from the politically responsible initiator a dedicated neutral and skilled process manager should be present who organizes the entire process in such a way that participants are kept at the table, remain interested and learning (Dieperink et al., 2012, p. 66).

3.4 National Adaptation Strategies

Integrated Coastal Zone Management is a strategy that mainly focuses on the European level, there are also many countries which have developed their own strategies on the matter of coastal management. Biesbroek et al. (2010) researched these National Adaptation Strategies (NAS) and compared several of them in a paper. They defined such adaptation strategies as 'a general plan of action for addressing the impacts of climate change, including climate variability and extremes' (Biesbroek et al., 2010, p. 441). Such a plan of action includes policies and measures with the aim of reducing the vulnerability of the particular country. These plans can be national, cross-sectoral, cross-regional or more local and sectoral (Biesbroek et al., 2010).

To compare these NAS Biesbroek et. al. (2010) identified six themes which were common in all NASs. These themes are 'the motivation behind establishing NASs; the interaction between science-policy and research coordination; approaches to communication and knowledge transfer; the ways in which tasks and responsibilities are distributed between different levels of governance; the institutional arrangements for incorporating adaptation into sectoral policies; and whether and how countries ensure that their adaptation strategies are implemented and reviewed' (Biesbroek et al., 2010, p. 442).

After comparison, Biesbroek et al. (2010) distinguish between drivers for adaptation policies and facilitating factors for adaptation policy. These factors and drivers contribute to a proper National Adaptation Strategy. 'Comparing the adaptation strategies from different countries is challenging because of the institutional, legislative, political and cultural differences which are reflected in, for example, the timing, structure, focus and legal status of the NAS and possible follow-up strategies.' (Biesbroek et al., 2010, p. 442). Yet, the researcher managed to find a number of general and overlapping aspects which are important to every National Adaptation Strategy. Drivers for adaptation policies are extreme weather events/impacts; economic costs of inaction; EU policies; scientific research; media; private sector interests; NGO advocacy; the UNFCCC; recognising opportunities; and examples from other countries. These are aspects that push towards initiating coastal management policies due to stakeholders or actual hazards. Then there are facilitating factors for adaptation policy which creates a situation that is needed to be able to form a proper and good working policy. They are preconditions to get to a

successful policy at the end of the process. These are political will; good cooperation between ministries; compatibility with other policies; active people with expertise taking the lead; sufficient human and other resources are available; sufficient knowledge is available; and suitable timing of the process (Biesbroek et al., 2010, p. 442).

To achieve a well-functioning National Adaptation Strategy a couple of things can help achieve this. First of all, coordination between sectors is important, but also targeted adaptation research and a good planning for implementation review and funding enhance the NAS. Furthermore, a NAS can also create opportunities such as development and export of knowledge about the coastal zone and its management and the possibility of spill over of policy integration and multi-level governance for non-EU policies. However, there are also some issues that hinder the functioning of NAS, which include a lack of coordination between administrative levels, a lack of stakeholder involvement and a lack of specialised knowledge. But an unclear division of responsibilities and scientific uncertainties can also be seen as throwbacks for National Adaptation Strategies. There are also other issues that can counteract the achievement of NAS, like cross-level and cross-sectoral conflicts which make cooperation difficult. A lack of resources and a lack of public support and awareness can also be problematic. Finally, the global impacts of climate change, but also political developments can overrule the proper development of a National Adaptation Strategy (Biesbroek et al., 2010, p. 448).

Other elements that are important for National Adaptation Strategies have been identified by Keessen et al. (2013). They point out four different issues which are relevant for successful Adaptation Strategies focussed on ecology. First, flexibility is needed in social systems and institutions to deal with change; secondly, institutions must be open to change to ensure broad participation in decision making and administration; third of all, there must be effective multi-level governance; and fourth, social structures are required which 'promote learning and adaptability without limiting the options for future development' (Keessen et al., 2013, p. 2). One of the principles that can be used to achieve this is that of 'stake, say and pay', which creates a shared responsibility with a long-term perspective and promotes sustainable behaviour among the stakeholders (Keessen et al., 2013).

3.5 Building with Nature

Another management strategy is that of Building with Nature. This strategy focuses particularly on the technical aspect of coastal management and the actual coastal defence infrastructure at the shore. It is an innovative way of coastal management and is part of the paradigm shift towards resilience and adaptation mentioned before in paragraph 3.2. 'Innovative concepts such as 'Building with Nature' provide a basis for coastal protection strategies that are able to follow gradual changes in climate and other environmental conditions, while maintaining flood safety, ecological values and socioeconomic functions' (Slobbe et al. 2012, p. 1). The Building with Nature approach is more considerate of the surroundings and functions in the coastal zone and creates a more flexible way of coastal management. Building with Nature uses the natural systems own dynamics and materials to manage it and use it for flood management. This means that more uncertainty and dependency is involved in the coastal management, which contradicts the approaches that have been used for most of the 20th century, known as the command-and-control approach (Van den Hoek et al., 2012).

Building with Nature is a management strategy which has been researched a lot in the last couple of years, especially through learning in practice. Ecoshape is an important part of this research group and has formulated the philosophy, guidelines and principles of Building with Nature (BwN). These principles guide the policy makers and developers through the process of realizing coastal management with this new strategy (Ecoshape, 2012). First of all, this approach is focused on problem solving with the natural system in mind. Second of all, there is an ecology-inspired and governance-sensitive opportunity seizing attitude. Also, this strategy is highly transdisciplinary and focuses on the multifunctional use and management of the coastal zone. By using the dynamics of environmental processes, optimal value can be added for the ecological and economic perspective. This shows that both the physical and socio-economic aspects of coastal management are important in Building with Nature. Furthermore, cooperation is key, which crystallizes in active stakeholder involvement and collaboration between stakeholders and developers. BwN also means more uncertainty, but this can be dealt with by generating more knowledge and flexibility. However, the BwN approach has many advantages which can already be seen in practice, such as a more natural coastal profile, less disturbance of the coastal ecosystem, development of valuable habitat, increased freshwater reserve and the potential of recreational value (Ecoshape, 2012). 'Its size, its visibility and its many stakeholders make it an issue of public, and thus political, debate. Decision-making is no longer a matter of coastal engineering, but one of integrated governance.' (Slobbe et al. 2012, p. 16). Also, public involvement raises awareness in society.

Building with Nature

Beeldbank.rws.nl

Slobbe et al. (2012) have identified three subsystems which are relevant to coastal protection, these are the biotic and a-biotic environment (ecology and sedimentation); man-made

infrastructures (all human interventions); and the governance of society (including institutional, legislative and informal). The broad spectrum of these subsystems shows that one should 'consider adaptation in a broader, cross-sectoral, and potentially cross-scale, context' (Thomsen, Smith & Keys, 2012, p. 2) and that there is a 'dynamic interplay between the social and ecological components' (Gallopin, 2006, p. 294). 'The relevance to coastal communities is that protect options based upon manipulative strategies are likely to be short term in effect, reduce the long-term resilience of social-ecological systems, and are expensive in the longer term. For example, hard protective structures can limit the impact upon socioeconomic systems in the short to medium term, but negatively impact upon ecological system components, such as salt marshes and wetlands, as these are progressively limited in extent or "squeezed".' (Thomsen, Smith & Keys, 2012, p. 6). Therefore, it is also in the interest of local communities to change their strategies towards more soft and resilient coastal management.

3.6 Conclusion

In this chapter coastal strategies have been discussed. We have selected conditions from three different strategies, namely Integrated Coastal Zone Management, National Adaptation Strategies and Building with Nature. All these strategies are part of a paradigm shift in coastal management. The last two decades many scientist and policymakers have made the switch from 'hard' to soft' engineering. This has resulted in more environmental-friendly coastal zone management.

Like Gunderson (2000), we have noticed that a couple of key ingredients are needed for successful coastal management. These can be captured in terms such as social learning, engagement and trust. Such conditions are part of the cooperation process and stakeholder involvement. Additionally, there also resources needed and the development of knowledge. Furthermore, there has to be a focus on sustainable outcomes for the coastal zone.

Conditions for successful coastal management:

- Undesirable situation (Dieperink et al., 2012)
- Sense of urgency (Dieperink et al., 2012)
- Long-term perspective (Pickaver, 2009)
- Stakeholder involvement/participation (Pickaver, 2009; Dieperink et al., 2012; Biesbroek et al., 2010; Ecoshape, 2012)
    - Respecting opinions and commitment (Dieperink et al., 2012)
    - Willingness to negotiate (Dieperink et al., 2012)
    - Flexible mandates, representatives with authority (Dieperink et al., 2012)
    - Clear image of role to be played (Dieperink et al., 2012)
    - Insight into mutual inter-dependencies (Dieperink et al., 2012)
    - Cooperation between stakeholders and developers (Ecoshape, 2012)
- Cooperation across sectors, scales and administrations (Pickaver, 2009; Biesbroek et al., 2010; Ecoshape, 2012)
- Clear division of responsibilities (Biesbroek et al., 2010)
- Financial and personal means and resources available (Dieperink et al., 2012; Biesbroek et al., 2010)
- Ecosystem-based approach (Pickaver, 2009; Ecoshape, 2012)
- Use of dynamic environmental processes (Ecoshape, 2012)
- Mechanisms for monitoring, evaluation and reviewing (Pickaver, 2009)

- Planning for implementation, data collection, decision making and management (Pickaver, 2009; Biesbroek et al., 2010)
- Strong, constant public and political support (Pickaver, 2009; Biesbroek et al., 2010)
- Long-term financial commitment (Pickaver, 2009)
- Transparent and clear documentation and access to information (Dieperink et al., 2012; Pickaver, 2009)
- Development and export of (specialised) knowledge (Biesbroek et al., 2010; Ecoshape, 2012; Dieperink et al., 2012)
- Spill over of policy integration and multi-level governance (Biesbroek et al., 2010)
- Dedicated neutral and skilled process manager is present (Dieperink et al., 2012)
- Results of the process can be formalized with existing legal instruments (Dieperink et al., 2012)
- Process has small and intermediate steps (Dieperink et al., 2012)
- Monitoring shows a demonstrable trend towards a more sustainable use of coastal and marine resources and added ecological value (Pickaver, 2009; Ecoshape, 2012)
- Improved protection and sustainable use of coastal zones (Pickaver, 2009; Ecoshape, 2012)

4. Methods

In this chapter the method of research will be elaborated upon. The research strategy, case study analysis, and the method of data collection, interviews, will be explained. Furthermore, the key actors and questions for the semi-structured interviews can also be found in this chapter.

4.1 Success conditions

In the two theoretical chapters on resilient coastal zones and coastal management strategies a number of theoretical success conditions have been identified. However, this research aims to find knowledge from practice and that is why the conditions will be compared with real life situations in the form of two case studies. The success conditions have been grouped into six subjects to get a better oversight of the various conditions. These categories are societal context, stakeholders, finances, process and planning, coastal zone-related conditions and knowledge. This categorization will be helpful in the analysis phase, as it gives information on which kind of conditions are relevant.

The chance that coastal management successfully contributes to more resilient coastal zones is higher if the following conditions are present:

Societal context conditions

- The situation of the coastal zone is undesirable.
- There is a sense of urgency about the situation of the coastal zone.
- There is a coastal management approach and plans have a long-term perspective.
- The coastal zone project has strong and continuous public and political support.

Stakeholder conditions

- Stakeholders are involved and can participate in the decision making process.

Proper participation includes: respecting one another's opinions and commitment; a willingness to negotiate with the other parties; flexible mandates which are held by representatives with authority in their organization; a clear image of the role which is to be played; insight into mutual inter-dependencies of stakeholders; and cooperation between stakeholders and developers.

- There is cooperation across sectors, scales and administrations.
- There is a clear division of responsibilities for all stakeholders.

Financial conditions

- Financial and personal means and resources are available to the project team.
- There is a long-term financial commitment by the stakeholders.

Process/planning conditions

- There are mechanisms for monitoring, evaluation and reviewing.
- A planning is made for implementation, data collection, decision making and management.
- There is transparent and clear documentation and access to information for all stakeholders.

- A dedicated, neutral and skilled process manager is present
- The results of the process can be formalized with existing legal instruments.
- The process has small and intermediate steps.

Coastal zone conditions

- The coastal zone can cope with major changes, both internal and external.
- The coastal zone is able to recover itself to its original state.
- The coastal zone is able to adapt to new circumstances.
- An ecosystem-based approach is used for the coastal zone project.
- There is a use of dynamic environmental processes for the coastal zone project.
- Monitoring shows a demonstrable trend towards a more sustainable use of coastal and marine resources and added ecological value.
- There is improved protection and sustainable use of the coastal zone.

Knowledge conditions

- There is development and export of (specialised) knowledge.
- There is spill over of policy integration and multi-level governance to other sectors and levels.

4.2 Case studies

In this research there has been chosen a qualitative research approach, due to the fact that these cases are all unique in both their physical and socio-economical characteristics and cannot be compared without making too many generalizations. Not just within but also outside the Netherlands it will be difficult to make quantitative comparisons. The reason for choosing cases in the Netherlands is that this particular country has much experience in the field of coastal management due to a long history of living close to the sea, economic interests and a dense population and will therefore be a good candidate in providing best practices.

Figure 4.1 Weak Links on the Dutch coast

Rijksoverheid, 2012

For this research a comparative case study approach is used. Two specific cases along the Dutch coastline are selected and compared to one another. Data concerning these case studies is generated by in-depth interviews with key actors for those cases. This way qualitative in-depth knowledge can be generated. In table 4.1 one can see the Weak Links of the Dutch coast and their characteristics. From these cases two are chosen.

Last but not least, one project can be added to this list, namely that of the Sand Engine in South-Holland. This project is not specific to one place, but is to provide coastal protection over a long line of coast northward of it. The Sand Engine consists of 20 million m3 of sand and covers 128 hectares. It stands at 7 meters above sea level and is meant to last for the next 20 years. It was completed in the summer of 2011 and it now supplies the Dutch coast with sediment. This type of coastal management is claimed to be one of the most resilient and sustainable types (Slobbe et al., 2012).

Assessing all the links is too much to compare properly within the aim of this thesis. Therefore, a choice needs to be made. The selected cases should meet a couple of requirements. Cases that are already finished might be more usable for research as more information on the process of implementation is available. When looking at the available information, it seems that finished projects provide more information and details about the coastal management and its process. This is a reason to choose a finished project, that way successes, drawbacks and conditions can be identified better. A unfinished project would not be able to provide all the necessary information and would therefore present an incomplete view. Furthermore, to be able to provide a broad recommendation two cases will be chosen that represent different characteristics (Verschuren & Doorewaard, 2010). That is why there has been chosen to study the Southern coast of Walcheren and the additional case of the Sand Engine. Southwest Walcheren represents the traditional style of coastal management, the Sand Engine represents a new approach in coastal management. As these two management styles will co-exist for quite some time to come, both cases are relevant for the research.

The Sand Engine has also been chosen because it is a special project that covers the entire coastline and it differs most from the other case in scale, strategy and technology. Southwest Walcheren is a much more regional case. These contradicting cases represent the different scales at which a coastal project can be executed. The case of the Southern coast of Walcheren is a case that finished in 2011, meaning that much information will be available and more is known about the experiences that the project has brought. Furthermore, the project did not finish too long ago, so experiences will still be fresh. This is also the case for the Sand Engine, which even though monitoring still continues, finished construction in 2011 as well. Finally, the two chosen projects lie in two very different provinces in the Netherlands, Zeeland and South-Holland, which makes it possible to compare two cases with different backgrounds, surroundings and management approaches. Altogether, these two cases have been chosen because they are finished projects in the same Dutch administrative context, but with different regional backgrounds and different coastal management approaches. These two case studies will form the basis for answering sub-question 4 in the research framework:

Which conditions have contributed to resilient coastal zones in practice?

Table 4.1: Characteristics of Weak Links along the Dutch coast

Location	Exact practices	Actors	Timeframe	Costs
Kop van North-Holland	Dune strengthening	Province of North-Holland Municipality of Zijpe	Start 2013	250 million for streng-thening and extra main-tenance
Hondsbossche & Pettemer Sea wall		Province of North-Holland Hoogheemraadschap Hollands Noorderkwartier Municipality of Zijpe & Bergen	Start 2013	
Noordwijk /Katwijk	Broadening dunes by 42 m, dike in dune	Province of South-Holland	Sept. 2007 - April 2008	
Scheveningen	Dike within a boulevard, 12 m at highest point, 1 km, broadening of coast by 40-70 m	Province of South-Holland Hoogheemraadschap Delfland Municipality of The Hague	Oct. 2009 – April 2013	75 million
Delflandse Coast	Coastal strengthening and nature development for compensating the Second Meuse Plain	Province of South-Holland Hoogheemraadschap Delfland Municipality of The Hague	Finished end 2011	
Flaauwe Werk	2 km long, 12.6 m high, 30 m broader, strengthening seadike	Province of Zeeland Water board Hollandse Delta	Sept. 2007 – March 2009	
Southwest of Walcheren	Strengthening dunes, heightening dikes by 11.5 m	Province of Zeeland Municipality of Veere & Vlissingen	? – 2011	
West-Zeeuws Vlaanderen		Province of Zeeland Water board Scheldestromen Municipality of Sluis	Under construction	6.687.000
Helderse Sea Wall		Province of North-Holland	??	
Kop van Voorne	Coastal strengthening by beach heightening and extra dunes	Province of South-Holland Water board Hollandse Delta	Aug. 2009 - July 2010	

(Min IenM & EZ, 2011, p. 19; Gemeente Sluis, 2010; Gemeente Veere, 2012; Gemeente Vlissingen, 2012; Hoogheemraadschap van Delfland, 2012; Provincie Zeeland, 2012; Provincie Zuid-Holland, 2012)

4.3 Document analysis

To collect data for the case study document analysis is an important research method next to the interviews that will be conducted. For the document analysis national reports, provincial coastal visions, municipal reports, governmental websites, project websites and various other policy documents have been used. With the data from these documents it is possible to make an overview of the situation and the development of the two selected case studies. Key actor interviews have provided the additional detailed data of the project process itself.

4.4 Key actor interviews

For the collection of data in-depth interviews have been used. To conduct the interviews, these were prepared by making a semi-structured question list. This way there can be some structure in the interview, but this will also leave room for unexpected findings. Those who are interviewed will have to be connected to the Weak Links. This connection can persist on many different levels. The selection of these key actors has been based on the Delta program 2012 and the coastal vision reports of the Province of South-Holland and Zeeland (Min IenM & EZ, 2011; Provincie Zuid-Holland, 2012; Provincie Zeeland, 2012). All these actors have been identified as key players in the process of improving the security of the Dutch coastline.

Case 1: Sand Engine

- Project bureau Sand Engine, Province of South-Holland
- Municipality of Westland
- Municipality of The Hague
- Ministry of Infrastructure and the Environment
- Deltares
- EcoShape
- World Wide Fund
- Ronald Waterman

Case 2: Southwest Walcheren

- Municipality of Veere
- Municipality of Vlissingen
- Water board Scheldestromen
- Province of Zeeland
- Ministry of Infrastructure and the Environment

4.5 Interview questions

In chapter two and three a number of conditions were identified. These conditions are the framework for the interviews and the data that needs to be gathered. Here these conditions will be operationalized into interview questions.

General

- What is your function exactly?
- In what way are you involved with the coastal management in the Netherlands?

Sand Engine

- In what ways is the Sand Engine sustainable?

- How was stakeholder participation organised?
- In what way is the division of responsibilities organised?
- How was the relation with other stakeholders?
- What role did the organisation play?
- Which factors were important for the success of the project? Why?
- What was the most important factor for the project to succeed? Why?
- With current knowledge, which aspects would you have done differently?

Southwest Walcheren

- How was stakeholder participation organised?
- In what way is the division of responsibilities organised?
- How was the relation with other stakeholders?
- What role did the organisation play?
- Which factors were important for the success of the project? Why?
- What was the most important factor for the project to succeed? Why?
- With current knowledge, which aspects would you have done differently?

The answers of the interviewees were analyzed and compare to the list of success conditions. The mentioning of the different conditions was registered per stakeholder, which led to the tables for each case study in chapter five. The presence of a condition was marked with a +. In case an interviewee indicated that the condition was essential or very important to the success of the coastal project, this was indicated by a ++ mark. This led to an overview of the presence and importance of the success conditions per stakeholder and per case through which comparison was possible.

4.6 Survey

In order to make to results of this thesis somewhat more general, a small survey has been held among the other Weak Links at the Dutch Coast. The project managers of each of these projects have been asked to fill in the survey which consists of statements based on the list of conditions and the outcomes of the in-depth interviews. The survey is made with the online tool Thesis Tools and has been sent to project managers of nine projects which can also be found in table 4.1 on p. 36, these are Kop van North-Holland, Hondsbossche & Pettemer Zeewering, Noordwijk, Scheveningen, Delflandse Kust, Flaauwe Werk, West-Zeeuws Vlaanderen, Helderse Zeewering and Kop van Voorne. The statements that have been included in the survey can be found in the appendices.

5. Results

5.1 Case 1: the Sand Engine

The first case is that of the Sand Engine, a pilot project along the coast of South-Holland. Due to its innovative and sustainable character it serves as a good example for future coastal projects (Van Weesenbeeck et al, 2014). First of all, a more detailed description of the Sand Engine will be given, after which the several stakeholders and their responsibilities will be discussed. Secondly, a small overview will be given of the decision and construction process of this project. Finally, the success conditions will be discussed.

5.1.1 Building the Sand Engine

The Sand Engine is located on the coastline of the Province of South-Holland, between the municipalities of Hague and Westland. The Sand Engine is connected to the coast at Ter Heijde and Kijkduin, west of the Hague. When the Sand Engine was built in 2011 it had the size of 256 football fields or 128 hectares. This should eventually result in 35 hectares of new beach and dunes (Projectbureau de Zandmotor, 2013). The Sand Engine consists of 23,5 million cubic meters of sand. This sand has been extracted 10 kilometres off the coast (Oome & Rietbroek, 2014). The Sand Engine is monitored constantly with the Argus tower, which is located on the highest spot of the sand plateau at seven meters above sea level. The Argus tower is 40 meters high and has eight cameras which film the changes of the Sand Engine (Projectbureau de Zandmotor, 2013).

Figure 5.1.1 The Sand Engine

www.dezandmotor.nl, 2014

The Sand Engine has been designed by the principle of 'Building with Nature' and works through the natural forces of wind, water and erosion. The idea is to let wind and waves redistribute the sand nourishments as they would do naturally. This way the sand will end up where it is needed as nature has a tendency to balance itself. Redistribution on the right places encourages the development of new dunes, which are an important part of coastal protection. Building with Nature differs from traditional sand nourishments in it time span, as it supply is only necessary every 20 years instead of every 5 years. This results in less disturbance of the ecosystems and gives it time to strengthen (Ecoshape, 2012).

5.1.2 Stakeholders and their responsibilities

In the pilot project of the Sand Engine several stakeholders were involved. The process started with five of the main stakeholders, but later on others were added to the group en became involved with the process.

Province of South-Holland

The Province of South-Holland is the initiator of the project and has been leading the developments. Until 2021 the Province is also responsible for the management and maintenance of the Sand Engine, after which Rijkswaterstaat will take over this responsibility. They have led the plan study phase of the project.

Ministry of Infrastructure and the Environment

Rijkswaterstaat is the governmental organisation in the Netherlands which takes care of waterworks, infrastructure and reachability. They manage all kinds of projects, including coastal management and flood risks. Rijkswaterstaat is closely connected the Ministry of Infrastructure and the Environment, which is more policy-based. They lead the project during the construction phase (Provincie Zuid-Holland, 2008).

Municipality of Westland

The municipality of Westland is where the Sand Engine was originally built, just above Monster. After construction the Sand Engine slowly started to spread out and entered the municipality of The Hague. The municipality monitors the safety on the beach, but is otherwise not particularly involved with the Sand Engine itself.

Municipality of The Hague

The municipality of The Hague is the other local government which is involved in the Sand Engine project. Like the other governmental organizations they were part of the project team. At the moment the Sand Engine lies only for a small part within the municipality of The Hague, but this will become more in the future. The municipality is responsible for general maintenance and safety of the beach.

Deltares

Deltares is a research institute which specializes in applied knowledge on water, soil and infrastructure. They focus on deltas, coastal regions and river areas. In the Sand Engine project they have contributed with research and modeling for the design of the Sand Engine.

Furthermore, they are also part of the monitoring group and use the new data which is retrieved from the Sand Engine (Deltares, 2012).

EcoShape

Ecoshape is a consortium which focuses on the concept of Building with Nature. In this consortium two Dutch dredgers have joined their expertise, namely Van Oord and Boskalis. Together with equipment suppliers and engineering consultants, as well as public parties such as government agencies and municipalities, applied research institutes, universities and academic research institutes they work on expanding the Building with Nature concept. For the Sand Engine they have been responsible for the construction and dredging the Sand Engine itself and have thought along in the design process (Ecoshape, 2012).

World Wide Fund

To represent nature and the environment, the World Wide Fund was also a partner of the Sand Engine project. In practice, this was done by Ark Nature Development, an organization which could advise on the ecological aspects of the project (L. Linnartz, 2014).

Dr. Ir. Ronald Waterman

Dr. Ir. Ronald Waterman is one of the co-founders of the Sand Engine and (co-)designer of many other coastal expansions along the Dutch coast, such as the Van Dixhoorndriehoek, the Second Meuse Plain and expansion along the Delflandse coast. These are designed with the concept of Building with Nature. Dr.Ir. Waterman started working with Building with Nature in 1980 and has been promoting the approach ever since through various political and administrative way. He advises among others the Province of South-Holland, the national government, the Harbor of Rotterdam, the Netherlands Water Partnership and is guest lecturer at seven Dutch universities (R. Waterman, 2014).

Figure 5.1.2 Timeline of the Sand Engine development process

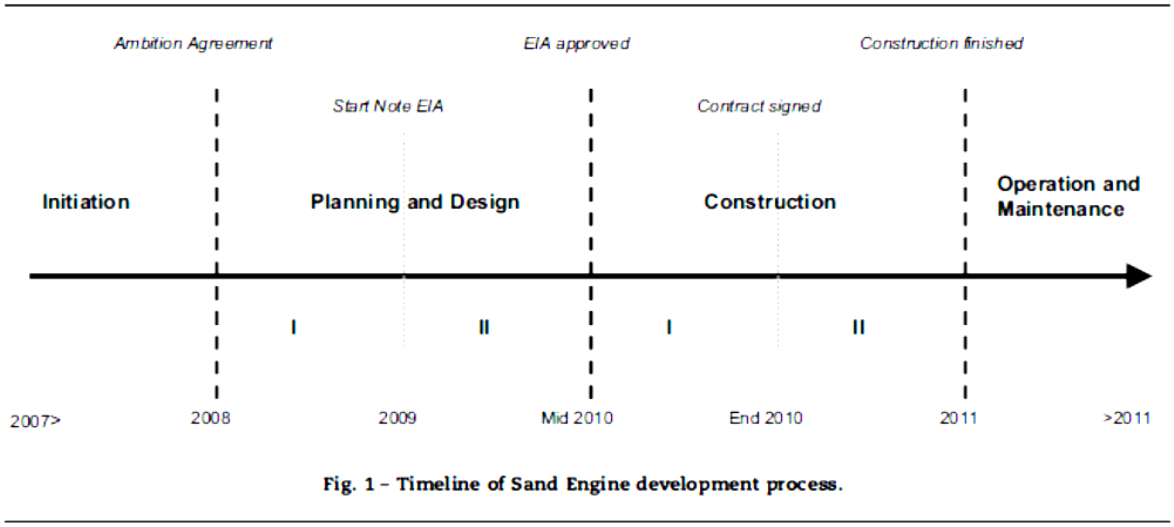


Fig. 1 – Timeline of Sand Engine development process.

Van den Hoek et al., 2012, p. 89.

5.1.3 Process of the Sand Engine

Van den Hoek et al. (2012) have analysed the development of the Sand Engine and divided this period into six phases (figure 5.1.2). The first phase is the initiation phase, which indicates the

start of the project. In this phase the potential ideas were brought up, stakeholder commitment was created and preliminary project goals were set. This phase ended in 2008 by drafting and signing an ambition agreement by the municipalities of The Hague and Westland, Rijkswaterstaat, Environmental Federation South-Holland and the province of South-Holland (K. Oome, 2014). These were the five main stakeholders for the pilot project. The next phase is Planning and Design I, in which the possible alternatives were explored, knowledge gaps were identified and the Environmental Impact Assessment guidelines were started. This was followed by the second part of Planning and Design, which involved the selection of the preferred alternative and designing mitigation measures for undesired effects. By the end of this phase in 2010 the Environmental Impact Assessment was approved and the planning preparations were finished (Van den Hoek et al., 2012). By the following phase, Construction I, contractors were invited to present estimates for building the pilot project. This was done in a different way as contractors were asked to present their plans with the sand for a fixed price instead of a fixed amount of sand and variable prices. The contractor which could supply the most sand (with a minimum of 20 million m3) for €50 million got the deal. This became the combination of Boskalis and Van Oord, they were able to supply 23,5 m3 of sand (K. Oome, 2014). Permits were then arranged and in the spring of 2011 Construction phase II started, resulting in the completion of the Sand Engine by the end of the summer. After the construction in 2011 the last phase started, which is the longest of all and which is still ongoing. This is the Operation and Maintenance phase. This phase is supposed to last for the next 20 years and consists of monitoring and the controlling of safety and the effects of the natural forces that change the Sand Engine continuously (Van den Hoek et al., 2012).

5.1.4 Success conditions

In the theoretical chapters on resilient coastal zones and coastal management a number of conditions were identified. Here the theory and practice come together. For the data the eight parties have been interviewed about the Sand Engine project between Ter Heijde and Kijkduin. In table 5.1 the results are shown in overview. Afterwards, the conditions are discussed per theme.

Table 5.1 Importance of success conditions at the Sand Engine

Presence of Conditions	**Province of South-Holland**	**Municipality of The Hague**	**Municipality of Westland**	**Ministry IenM**	**Deltares**	**Ecoshape**	**WNF**	**Dr. Ir. Ronald Waterman**
Undesirable situation	+			+		+		+
Sense of urgency								
Long-term perspective	+	+		+	+	+		+
Public and political support	++	++	++	++	++	++	++	++
Stakeholder participation	+	+	+	+	+	+	+	++
Stakeholder cooperation across sectors, scales & administrations	+	+	+	+	+	+	+	+
Clear division of responsibilities	+	+	+		++	+	+	
Long-term financial commitment	+	+	+	+	+	+		+
Financial and personal means and resources available	+	+	++	+	++	+	++	+
Mechanisms for monitoring	+	+	+	+	+	+	+	
Planning for implementation	+		+	+				+
Transparent and clear documentation and access		+	+		+			+
Results can be formalized legally	+							+
Small and intermediate steps in process	+	+	+	+		+		+
Dedicated neutral and skilled process manager								
Coastal zone copes with changes	+			+	+	+	+	+
Coastal zone recovers to original state	+				+	+	+	+
Coastal zone adapts to new situation	+			+		+		+
Ecosystem-based approach					+			
Use of natural dynamics	+	+	+	+	+	+	+	++
Trend towards more sustainable use & added ecological value of Coastal zone	+		+	+	+	+	+	+
Improved protections and sustainable use of Coastal zone	+		+	+	+	+		+
Development and export of knowledge	+	+	++	+	+	+		++
Spill over of policy integration and governance	+	+		+		+		+

+: condition is present; ++: conditions is essential.

Societal context conditions

What one sees as an undesirable situation depends on one's perspective. For the Province of South-Holland, the Ministry of Transport and the Environment, Ecoshape and Ronald Waterman there is an undesirable situation at the Dutch coastline south of The Hague. However, to the other stakeholders, the municipalities of Westland and The Hague, Deltares and WNF, there was no situation that requires immediate action. None of the stakeholders feel there is a sense of urgency when it comes to the Sand Engine. Coastal defence structures had just been updated due to the Weak Links projects, which also covered the Delflandse coast. So there was no

immediate danger of flooding. This urgency was actually more pressing at the coast of North-Holland, where the Weak Links project had not been finished yet. (K. Oome, B. Girwar, 2014).

The Ministry of Infrastructure and the Environment would have preferred to use the project for the Hondsbossche and Pettemer seawall. However, the Ministry pointed out that this could have been too much of risk for North-Holland as the Sand Engine is an experiment and cannot assure the safety of the region. Other coastal defence structures would have to be up-to-date, just to be sure (W. de Vries, 2014). The Sand Engine focuses on a long-term perspective, as is mentioned by six out of eight parties (See table 6.1.1). The Engine is designed to function for at least 20 years, which is a long-term perspective. Especially when compared to regular schedules of sand supplying, which occurs every four or five years. Furthermore, the underlying concept of Building with Nature is a long-term approach (R. Waterman, 2014). This experiment is an investment in future coastal defence mechanisms (S. Aarninkhof, 2014).

One condition which all parties consider to be essential in this project is strong public and political support. As there was no urgency in the sense of coastal safety, several parties had to be convinced to attain approval for the Sand Engine. Without political and public support, the Sand Engine would not have been there. This holds for various levels of governmental organisations, local and national. The Province was the initiator of the project, however, internally there also were some policy makers and politicians that had to be convinced of the idea. Ronald Waterman was involved in this process of proposal and voting in the Provincial States meetings and the Dutch House of Representatives (R. Waterman, 2014). After the Province decided to take on this coastal project the Ministry of Infrastructure and the Environment had to be convinced, as the project was too large for the Province to execute by itself. At that time the Ministry was looking into alternatives for coastal maintenance, however, there were concerns about the finances of the project, as it would require additional funds to create the Sand Engine and the budget at the time was already tight. On the other hand, the scientific field and the dredgers were in favour of the project. Also the WNF had been lobbying for sustainable approach of coastal maintenance for some years and were inclined to join the project (K. Oome, 2014). After much promotion by the Province of South-Holland in both the public and the political realm, the Ministry reassessed its financial possibilities and negotiated a shared financial responsibility with the Province, as the Ministry was interested in the innovative aspects of the Sand Engine (W. de Vries, 2014). This shows that support of various parties is necessary in order for such a project to take off. Koen Oome stated that none of the involved parties could have realised the Sand Engine on their own, every party contributed but also needed the other parties for the project to succeed.

Stakeholders conditions

The Sand Engine involved many stakeholders who partake in a project team which was organised by the Province of South-Holland. All parties believe stakeholder participation is important for the success of the problem. Ronald Waterman states that it is essential for such a project to succeed (R. Waterman, 2014). With many stakeholders also many different interests and opinions came to the table. These were all given a place by the Province and they made everyone feel heard and respected in their opinions (L. Linnartz, A. van Blanken, N. Al, S. Aarninkhof, 2014). Leo Linnartz praises the Province for their coordination skills during the process. This generated a willingness to negotiate among the parties. There were many project

meetings and all parties were kept informed about the process, also the public was informed during various sessions (A. van Blanken, 2014).

Nonetheless, one stakeholder joined the process rather late, namely Dunea, the drinking water company. This was because drinking water was not associated with a coastal project. However, when drinking water issues occurred, they were invited to the project team to look at the problems (W. de Vries, S. Aarninkhof, 2014).

All parties agree that there was cooperation across sectors, scales and administrations. Private, public and knowledge organisation all worked together, local and national (S. Aarninkhof, 2014). However, opinions are divided on how well cooperation went. Ecoshape called the cooperation perfect and therefore marked this condition as essential for the project. They were also taught to cooperate with different disciplines such as ecologist and public administration (S. Aarninkhof, 2014). But the Ministry experienced some difficulties in the beginning of the process and the negotiations due to different perceptions about the Sand Engine. This improved later on as issues were solved and agreements on finances and responsibilities were made (W. de Vries, 2014). Deltares also experienced some issues in their cooperation with NatureCoast, another research programme. There were no clear rules on the sharing of data and this led to some problems about data ownership and the role of each research organisation (A. Boon, 2014).

Finally, there were some cooperation difficulties around the lagoon and river where the current became particularly strong. This was predicted by the research institutes such as Deltares. However, the Province feared for swimmers safety and took measures by placing some stones in the tidal river. The problem was that this was not communicated well between the parties, with led to some arguments, as the stones had changes the environmental circumstances and thus the data for research. Yet, in the end the change was used as an advantage to measure a different situation and the problem was smoothed over (A. Boon, 2014).

Finance conditions

Finances and other resources such as construction supplies are considered to be important by all parties. The municipality of Westland, Deltares and WNF even believe it is essential for the success of the project. €12 million came from the Province of South-Holland and €58 million was invested by the Ministry of Infrastructure and the Environment. Also, some funding was received for research and monitoring from Eco and EFRO (A. Boon, S. Aarninkhof, 2014). Long-term financial commitment was appointed as an important condition by all parties but WNF. Due to the fact that the Sand Engine was a large and long-term project, this important in order to get approval. However, this was difficult as cost estimates were not very precise at the beginning of the process (K. Oome, 2014).

Process/planning conditions

All but Ronald Waterman value the mechanisms for monitoring, evaluation and reviewing for the success of the project. There are several monitoring programmes and evaluation sessions, such as research programmes of Deltares, Imares, NatureCoast, Witteveen+Bos and Ecoshape. For this purpose field research is conducted and the Argus Tower monitors the Sand Engine daily (L. Linnartz, A. Boon, 2014). After five years there is an official evaluation by the Ministry of Infrastructure and the Environment on the four goals that have been set (W. de Vries, 2014).

Planning for implementation, data collection, decision making and management was valued by the Province, the municipality of Westland, the Ministry of Infrastructure and the Environment and Ronald Waterman. An example of this in the ambition agreement which was signed by all parties in 2008, the plan study in 2009 and the Environmental Impact Assessment in 2010 (K. Oome, S. Aarninkhof, 2014). But also the management agreement contributed to the planning (W. de Vries, 2014).

Transparent and clear documentation and access to information is considered to be important by the municipalities of The Hague and Westland, Deltares and Ronald Waterman. The Province and Waterman also consider the legal formalisation of the results to be important for the success of the project. Official recognition can help the process along. There were many steps involved in the process as the Dutch policy making process is made of many different procedures and approvals. This meant a couple of years of preparation between the first meetings in 2003 and the construction in 2011 (K. Oome, 2014). For some these steps made it easier to follow the process, like the municipality of Westland, other felt rushed at times due to the vast amount of decisions that had to be taken, like the municipality of The Hague (A. van Blanken, N. Al, 2014). Beside the municipalities the Province, the Ministry, Ecoshape and Ronald Waterman value these steps in the process. The process was led by a project team with a process manager from the Province of South-Holland, nonetheless, there was no neutral manager as each party had some interests in the project. This is why none of the parties mentioned this as a condition. However, this does not mean that there were no skilled and dedicated people involved in the process. This is clarified in the last paragraph of this section.

Coastal zone conditions

The Province, the Ministry, Deltares, Ecoshape, WNF and Ronald Waterman all believe the coastal zone can now cope with change and recover from this. The Province, the Ministry, Ecoshape and Ronald Waterman consider the coastal zone to be able to adapt to a new situation. This is created by dynamic balanced coastline, which is a sand-based construction (R. Waterman, 2014).

Sand Engine

The ecosystem-based approach is not a condition here, only Deltares mentions this approach as they also research the ecosystem, but it is not leading for the Sand Engine (A. Boon, 2014). There is use of dynamic environmental processes, as is confirmed by all parties, Ronald Waterman even considers it to be essential. The Sand Engine is designed from the Building with Nature perspective which uses the material, forces and interactions that are present in nature. These forces are tidal movement, waves, gravity, wind, sea currents other than tides, river currents, rain, sun, interaction between dunes and vegetation and interaction with marine organisms (R. Waterman, 2014). It is a solution as nature itself would solve the problem, the system fixes itself (S. Aarninkhof, 2014). With the sand nourishments the foreshore is built up again, making it possible for waves and currents to influence this material again (K. Oome, 2014).

All parties but the municipality of The Hague mention a trend towards more sustainable use and added ecological value of the coastal zone as a condition for the success of the project. The Sand Engine is a nursery for marine life and is a buffer for sea level rise due to its flexibility. Instead of working against nature there is now cooperation with nature (K. Oome, B. Girwar, 2014). On the Sand Engine some new vegetation and birds have been seen and also seals come there often (A. van Blanken, 2014). The area has become more ecologically diverse and has a small ecological footprint due to the fact that there is construction only once every 20 years (S. Aarninkhof, 2014). This new way of sand nourishment gives species the opportunity to reach adulthood and reproduce and thereby strengthens the system. On the Sand Engine there is now beach grass, which helps the first dune formations grow (L. Linnartz, 2014).

The Province, municipality of Westland, the Ministry, Deltares, Ecoshape and Ronald Waterman all consider the improved protection and sustainable use of coastal zones to be important for the success of the Sand Engine project. One of the goals of the project was coastal safety (A. Boon, 2014). However, not much can be said about this yet as the monitoring will continue for another 17 years before one can confirm whether the method works in practice. What can be said is that the first results are according to plan (W. de Vries, 2014).

Knowledge conditions

All parties but the WNF consider innovation and knowledge to be a condition for the project to succeed. The Sand Engine is a subject of study for 19 PhD students and provides input for a large data base on various disciplines, such as morphology, hydrology and ecology (A. Boon, 2014). The project also stimulates the export of knowledge as foreign delegations come to see whether they can apply the same methods, like the Danish who deal with similar problems (B. Girwar, 2014). Ecoshape benefits from this greatly as the Sand Engine is a good example of what the Dutch dredgers are capable of and this can lead to new international projects (S. Aarninkhof, 2014). The Sand Engine has generated as policy spill over as well, for example with the Sand Engine Conference in March 2014 where results were discussed and policy steps were re-enacted to learn.

Unexpected condition: Leadership and dedication

Beside the conditions that were found in the literature and identified here, some other conditions came up as well. When the interviewees where asked what the most important condition had been for the project they often mentioned personal drive, mental ownership and leadership as important for the succeeding of the project. Only the municipality of Westland and

Deltares did not mention this. Almost everyone spoke of Lenie Dwarshuis, the Deputy in the Province of South-Holland, who took on the Sand Engine project and made it her own. She believed in the project, was willing to fight for it and led the Province in convincing other parties (K. Oome, 2014). Also Ronald Waterman is mentioned as one of the driving forces of the Sand Engine Project (B. Girwar, 2014). This driving forces and mental ownership was considered to be essential by the Province of South-Holland. Also the Ministry mentions the enthusiasm with which the Province led the project (W. de Vriesl, 2014). Ecoshape mentions the leadership of Lenie Dwarshuis and Ronald Waterman, who put their reputation on the line and knew how to get the message across (S. Aarninkhof, L. Linnartz, 2014). This political force was very important, and it was this commitment which led to the movement and the involvement of the stakeholders (N. Al, 2014). Ronald Waterman has been working on these plans for many years and his work at the Provincial States and his commitment have paid off as the Sand Engine project has become real. This is the result of years of convincing both the public and private stakeholders (R. Waterman, 2014),

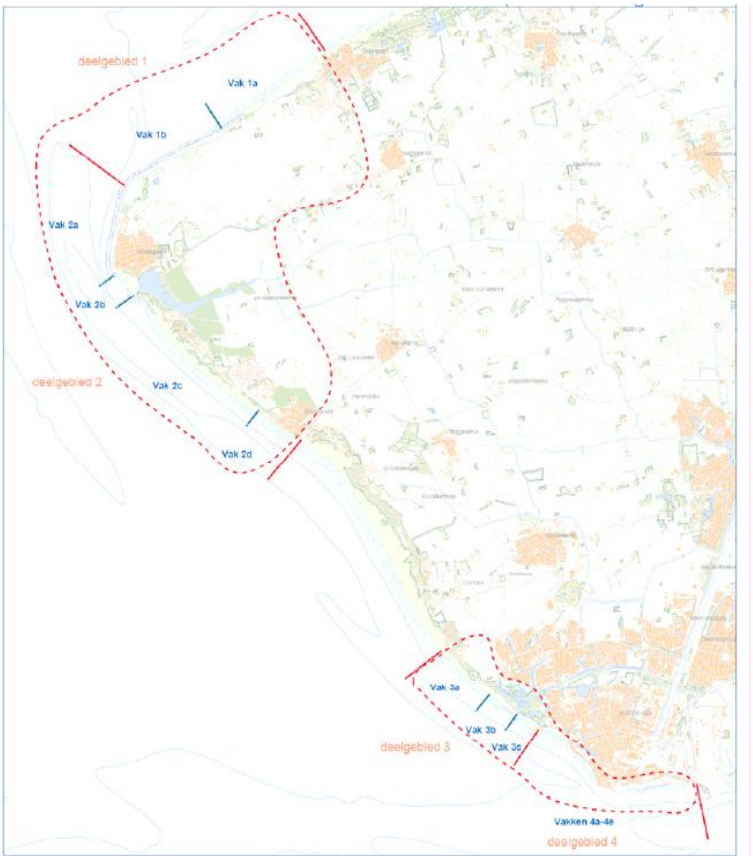
5.2 Case 2: Southwest Walcheren

In this part of the chapter the results of the second case study will be discussed, that of Southwest Walcheren. First of all, a short summary will be given about the Weak Links programme, which this project is part of. Secondly, the five stakeholders and their responsibilities will be outlined to portray the situation of the project. Thirdly, the presence and importance of the success conditions will be discussed.

5.2.1 Weak Links

In 2003 a report of the Ministry of Transportation and Water Management (now Ministry of Infrastructure and the Environment) stated that the coastal defence was not up-to-date and that a number of locations were an immediate risk for flooding either now or in the near future. After further research and tests eight locations were appointed as a priority and named the 'Weak Links' (Waterschap Zeeuwse Eilanden, 2007a). In the next couple of years these Weak Links would be dealt with by the concerning Provinces: North-Holland, South-Holland and Zeeland. Since 2007 construction work has been done to improve these locations, of which the last one is expected to be finished in 2015. In Zeeland there are two regions which were vulnerable in 2003: West-Zeeuws Vlaanderen en Southwest Walcheren. The focus here is on the latter, an area which stretches from Vlissingen to Domburg. This is the focus of this case study, in this area there are two projects, that of the Westkapelse Seadike and Nolle-Westduin, at the boulevard of Vlissingen.

Figure 5.2 Weak Link areas of Walcheren



Provincie Zeeland, 2006

5.2.2 Stakeholders and their responsibilities

The Weak Links project uses an integrated and decentralized approach. This means that the project is organized on a regional level, in this case by the Province of Zeeland. Due to the integrated approach other governmental organizations are also closely involved, like the Water board and the concerning municipalities. These stakeholders work together and have made clear agreements about the division of roles and responsibilities. This was necessary in order to have a clear and structured working process.

Province of Zeeland

The Province was the leader and main responsible party of this project. The Province organized the project and set up a project bureau for the Weak Links. To lead the project bureau, three external specialists were hired from Haskoning. The Province was responsible for the first part of the project, the plan study phase. This meant getting all the stakeholders together and making a plan for the coastal protection update and combining it with spatial quality. An intention agreement was part of this plan (L. Dekker, 2014; Ministerie van Verkeer en Waterstaat, 2009).

Water board Scheldestromen

The Water board was responsible for the technical details of the plan and the construction phase. In 2007 the Water board became the leader of the project team to execute the plans. They focused specifically on coastal safety and the variations that were possible to assure this, but also took care of the spatial quality aspects of the project. Furthermore, the Water board Scheldestromen is also responsible for maintenance of the dikes and dunes (A. Marinisse, 2014; Ministerie van Verkeer en Waterstaat, 2009).

Municipality of Vlissingen

The municipality of Vlissingen was part of the project team as Nolle-Westduin is part of their jurisdiction and also parts of the boulevard in Vlissingen needed improvements. They also had a representative in the project team. The municipality was involved from the very beginning of the plan study phase. For them the spatial quality was an important reason to be involved in the process. They were responsible for the necessary permits and the land use plan on the municipal level (W. Vael, 2014; Ministerie van Verkeer en Waterstaat, 2009).

Municipality of Veere

The municipality of Veere covers a large area and Westkapelle is part of that area. That is why they were represented in the project team for the Westkapelse Sea dike. They were also involved in this project team from the beginning of the plan study phase. Their responsibilities were the permits and the municipal land use plan (S. Vasseur, 2014; Ministerie van Verkeer en Waterstaat, 2009).

Ministry of Infrastructure and the Environment

The Ministry of Infrastructure and the Environment (then Ministry of Transport and Water Management) was the initiator of the coastal projects as they had ascertained that the safety was not up-to-date. However, they delegated the execution of the projects to the Provincial level and were only involved as funder and scientific research on a broader level. Later on in the process the Weak Links projects were combined with the High Water Protection Programme (HWBP).

5.2.3 Success conditions

In the theoretical chapters on resilient coastal zones and coastal management a number of conditions were identified. Here the theory and practice come together. For the data the five parties have been interviewed about the projects at Nolle-Westduin and the Westkapelse Sea dike. In table 5.2.1 the results are shown in overview. Afterwards, the conditions are discussed per theme.

Table 5.2 Importance of success conditions in Southwest Walcheren

Presence of Conditions	**Province of Zeeland**	**Water board Schelde-stromen**	**Municipality of Vlissingen**	**Municipality of Veere**	**Ministry of Infrastructure**
Undesirable situation	+	+	+	+	+
Sense of urgency	+			+	
Long-term perspective			+	+	+
Public and political support	++	+		+	+
Stakeholder participation	+	+	+	+	+
Stakeholder cooperation across sectors, scales & administrations	+	+	+	+	+
Clear division of responsibilities	+	+			+
Long-term financial commitment	+	+	++		+
Financial and personal means and resources available	++	+	++	+	+
Mechanisms for monitoring	+	+	+	+	+
Planning for implementation	+	+		+	+
Transparent and clear documentation and access		+			+
Results can be formalized legally	+		+	+	+
Small and intermediate steps in process	+	+	+	+	
Dedicated neutral and skilled process manager	+				++
Coastal zone copes with changes		+	+		
Coastal zone recovers to original state					
Coastal zone adapts to new situation					+
Ecosystem-based approach					
Use of natural dynamics					
Trend towards more sustainable use & added ecological value of coastal zone	+	+	+		+
Improved protections and sustainable use of coastal zone	+	+	+	+	+
Development and export of knowledge	+	+	+	+	
Spill over of policy integration and governance	+		+	+	+

+: condition is present; ++: conditions is essential.

Societal context conditions

First of all, it was an undesirable situation that has led to the Weak Links projects. After examination the Ministry of Transportation and Water Management identified unsafe locations

on the Dutch coastline. These locations were either already unsafe or were expected to become unsafe in the near future due to the expected sea level rise and higher storm intensity and coastal erosion due to currents in the tidal inlets (Waterschap Zeeuwse Eilanden, 2007a). Related to this undesirable situation was a sense of urgency, which was particularly strong in Zeeland according to the Province and municipality of Veere (L. Dekker, S. Vasseur, 2014). They appointed this commitment to a strong connection with the region and the coast, but also to the storm in 1953, which devastated the Province of Zeeland to great extent. This could explain why the public here is inclined to favour coastal safety projects, as they have experienced what can happen if the issue is not dealt with (S. Vasseur, 2014).

The Weak Link project at Southwest Walcheren has a long-term perspective which is visible in several aspects of the project. The general Weak Links project is based on a long-term perspective as it aims to secure coastal safety until 2050 (Provincie Zeeland, 2006). The solutions for these unsafe locations can also be categorized as long-term. The dunes are prepared for another 50 years, whereas the dikes will be able to last for another 100 years. At Nolle-Westduin an exception has been made and the dune area has also been reserved for the next 100 years. This enables the vegetation to strengthen for a longer period of time before new sand is added to the area, which creates stronger dunes (L. Dekker, W. Vael, A. Marinisse, 2014). Also, sand is used as building material wherever possible, which is the case at parts of Nolle-Westduin. At the Westkapelse Sea dike this was not a possibility as currents and waves are too strong at that location. However, the beach has been broadened there to take the pressure off the dike. This is in line with the view of the National Coastal Vision (Deltaprogramma, 2013). Furthermore, these coastal structures are expandable, which means that future adjustments or renewals can be executed easily and incorporated into the existed dikes and dunes. This means lower costs and fewer materials in the future (B. Kornman, 2014).

Finally, in the Weak Link projects the aim has been to combine updating coastal safety measures with the improvement of spatial quality. Where possible these issues were dealt with at the same time in an integrated approach. In Southwest Walcheren this is best visible at Vlissingen, where the boulevard is combined with the dike and becomes a dike-in-dune construction towards Zoutelande. This way the view is more smooth and natural and there is no clear divide between the dike and the dunes at Zoutelande (W. Vael, 2014).

The project was supported by all the five governmental parties and, as a national plan, received political support from the national government. As mentioned above the public in Zeeland feels closely connected to the coast, which meant that in general the projects were well supported by the public (L. Dekker, 2014). However, there were some struggles with the public in the case of Nolle-Westduin, where the spatial quality constructions meant creating a new forest which led to expropriation of a few farmers. These people appealed against these decisions and the High Court is still deliberating about the verdict at the moment. Also, citizens were concerned about the parking facilities and the associated traffic along the boulevard of Vlissingen. However, this was solved in a more informal way (A. Marinisse, 2014). Furthermore, people were enthusiastic, shared their ideas and information meetings were well visited (L. Dekker, 2014). Political support was uncertain when state Secretary Bleeker made some budget cuts in 2011 on the nature projects. These funds were reserved at the Province of Zeeland for extra nature compensation near Vlissingen, which had already experienced many difficulties. Without secure

funding the municipality of Vlissingen was not able to approve this nature compensation in the land use plans and only the mandatory nature compensation will be executed (W. Vael, 2014).

Stakeholders conditions

The Weak Link projects are embedded in a new approach of integration and decentralization. This approach aims to involve all stakeholders concerned with the project. By appointing the organization to the Province, the project can count on a more regional expertise. The Province has closer relations with the municipalities and Water Boards, which makes cooperation easier. Cooperation in the Province of Zeeland was well organised by a project bureau with a project team in which all the governmental parties were represented (L.Dekker, A. Marinisse, W. Vael, S. Vasseur, 2014). However, in the Province of North-Holland this was not so well organised, municipalities and Water Boards were not involved from the beginning, which lead to many delays (B. Kornman, 2014).

Westkapelse Sea dike

The Province of Zeeland involved the municipalities and the Water Board from the beginning of the plan study phase, in which alternatives were researched and letters of intent were drawn up. These letters of intent ensured a clear division of roles and responsibilities. Due to this early involvement the municipalities of Vlissingen and Veere felt acknowledged and heard. For the Water Board Scheldestromen meant the opportunity to be actively involved from the beginning of the project and work on relations with the municipalities of Veere and Vlissingen (L. Dekker, 2014). Also, the public was involved with the project in several ways. In Vlissingen there were a number of public consultations about the plans around the boulevard (W. Vael, 2014). The

municipality of Veere included the village council and entrepreneurs association of Westkapelle to get better insights into the opinions of the locals (S. Vasseur, 2014). The town council of Veere also actively contributed to the process and discussion making and had various meetings with the project team. Each of these parties were respected for their opinions and concerns. An example of this is that the municipality of Veere and the Province of Zeeland did not agree on the preferred alternative for the Westkapelse Sea dike in which the thoroughfare was at stake. The Province accepted the wishes of the municipality of Veere and a different alternative was chosen in which the concerning road would stay (L. Dekker, 2014). This shows a willingness to negotiate.

Financial conditions

Financial means are considered to be important by almost all parties. Only the ministry does not appoint great value to these conditions. However, this can be explained as the ministry is the subsidizing party and not executing the project itself. Therefore the ministry is not depending on financials means. The Province of Zeeland and the municipality of Vlissingen consider financial means to be very important and even appoint this condition as decisive. Long-term financial commitment is considered to be important as well. Especially in the case of Nolle-Westduin uncertainty about finances resulted in the failure of a part of the nature compensation plan. This can be attributed to the zoning legislation on the municipal level in the Netherlands (W. Vael, 2014).

Process/planning conditions

Not all process and planning conditions are equally important. All five parties have contributed to a process evaluation initiated by the Ministry of Transportation and Water Management in 2009 for all of the Weak Links (Ministerie VWS, 2009). This evaluation concerned the plan study phase and discusses successes and points of improvement. Also, a couple of monitoring programmes have been set up since the realisation of the projects, one for the bird population at the Westkapelse Sea dike and the other for inventory of species in the dune area at Nolle-Westduin (A. Marinisse, 2014). These are part of the Nature Protection Law.

The planning for implementation, data collection, decision making and management is mentioned by all parties except the municipality of Vlissingen. An example of this is Zeeuws Overleg Waterkeringen (ZOW), a platform for all concerning parties dealing with coastal protection infrastructure in the Province of Zeeland. Also, in the project teams feedback moments were created for big decisions during the process (L. Dekker, 2014). These feedback moments assured that every party was able to follow the process and be up-to-date about the last decisions and procedures. This was much appreciated by the municipalities of Vlissingen en Veere (W. Vael, S. Vasseur, 2014) These project teams were organised per area, one for Westkapelse Sea dike and one for Nolle-Westduin. For these project teams external project leaders were hired from Haskoning, who brought the expertise and knowledge necessary for these projects which were not available at the Province at the time (Ministerie VWS, 2009). These project leaders provided in the condition of dedicated neutral and skilled process managers and created a well working project bureau (L. Dekker, 2014).

Transparent and clear documentation and access to information are not mentioned explicitly by any of the parties, except for the Ministry of Infrastructure and the Environment (B. Kornman, 2014). However, all parties mention the importance of a clear division of responsibilities and

written agreements about these responsibilities to avoid problems later in the process. The results of the negotiations and agreements were formalized legally in various documents such as the Provincial Coastal Plan, the Coastal Plan for Southwest Walcheren by the Water Board Zeeuwse Eilanden and the municipal land use plans (L. Dekker, A. Marinisse, W. Vael, S. Vasseur).

Coastal zone conditions

The Weak Link project in Southwest Walcheren has led to improved protection and sustainable use of the coastal zones as the coastal defence structures have been updated properly (B. Kornman, 2014). Due to the projects the coastline is now better equipped to deal with changes, such as sea level rise. The Westkapelse Sea dike has been strengthened and broadened and has been made resistant against sea water overspill (A. Marinisse, 2014). At Nolle-Westduin the dunes have been strengthened and the dike has been updated as well (W. Vael, 2014). In this project there has been no use of an ecosystem-based approach. Dynamic environmental processes have been used to some extent at Nolle-Westduin where the dunes are part of the coastal defence. This, however, is not the case at the Westkapelse Sea dike, where it is only possible to guard coastal safety with a dike. The aforementioned monitoring programmes show some trends towards added ecological value as several species have returned in higher number than before construction (A. Marinisse, 2014). Also, the solutions have been created with the idea of long-term management and to leave the area at peace at much as possible in order for the species to prosper (A. Kornman, L. Dekker, 2014).

Boulevard of Vlissingen

Knowledge conditions

These two specific projects at the coastline have not generated any specialised knowledge. However, the municipality of Vlissingen mentioned some developments in the 1980s which are now known as the 'Vlissings model' in the National Coastal Vision (W. Vael, 2014), which involves apartment buildings with convertible floors build in. These can later on be used for dike reinforcements. Furthermore, the municipality of Veere has mentioned a pilot of the national government at Zoutelande which involves keeping the fairway in place as it tends to move towards the coast (S. Vasseur, 2014). Policy integration has been one of aspects which has been well implemented in the Weak Links project in Southwest Walcheren. The Water board, Province en both municipalities stated to take this experience with them to future projects and have shared their experiences with other governments during platforms on the projects (L. Dekker, 2014; Ministry of Transport and Water Management, 2009).

Unexpected condition: Leadership and dedication

Beside the conditions that were found in the literature and identified here, some other conditions came up as well. When the interviewees where asked what the most important condition had been for the project they all responded that personal drive and leadership were important for the succeeding of the project. The Province of Zeeland mentioned the trust among the stakeholders from earlier projects and the commitment people from Zeeland have towards the coast. The Water board Scheldestromen pointed out the administrative force behind the project team and bureau. The municipality of Vlissingen spoke of the governmental will which came into being by the personal drive of people in the project team. The municipality of Veere mentioned the consensus and solidarity of the region as an important condition. Finally, the Ministry of Infrastructure and the Environment appointed the drive of people in the project team as essential to the success.

This shows that not just processes and checklists matter, but also the people that pull the project. A charismatic leader or someone who is willing to put their reputation on the line because they believe in the project, can turn a project into a real success.

5.3 Survey: the other Weak Links

To be able to generalize the results of the two case studies somewhat more, a survey has been carried out. This will give an idea of whether the two case studies were representative for other coastal projects along the Dutch coastline. After analyzing the case studies of the Sand Engine and Southwest Walcheren the most mentioned success conditions were selected. These conditions were adapted to statements and put together in an online survey. This survey was then sent to the project managers of the other nine Weak Links in Zeeland, South-Holland and North-Holland. It is expected that the outcomes of the survey will be positive as this will confirm the importance of the success conditions which were identified in the two case studies of Southwest Walcheren and the Sand Engine. If this is not the case and the outcomes are mostly negative, this could suggest that the two case studies are in independently standing cases and do not compare to other coastal projects along the Dutch coastline. This would affect the possibility to generalize the results of the case studies.

Table 5.3.1 Survey response

	Weak Link	**Response**	**Function**
1	Delflandse kust	Yes	Project manager of plan study phase
2	Flaauwe Werk	Yes	Policy advisor
3	Helderse Zeewering	None	
4	Hondsbossche & Pettemer Zeewering	None	
5	Kop van North-Holland	None	
6	Kop van Voorne	Yes	Communication advisor
7	Noordwijk/Katwijk	Yes	Project manager
8	Scheveningen	None	
9	West-Zeeuws Vlaanderen	Yes	Project leader

Five out nine project managers responded to the survey, which is 56%. This means a non-response of four. None of the project managers in North-Holland responded to the survey. In South-Holland only the project manager of Scheveningen did not respond, the other four project managers did fill out the survey. In Zeeland only one other Weak Link project was left, of which the manager did respond to the survey. This means North-Holland will not be included in the analysis of the survey outcomes.

In table 5.3.2 the outcomes of the survey are shown. The five respondents mostly agreed with the statements. Some neutral answers were given, but none disagreed with the statements. A sense of urgency seems to be the most important as all five respondents marked this as completely agreeable. Long-term financial commitment was considered least important but still valuable. Only the project manager of Flaauwe Werk seems to have a neutral stand on this statement, which he also has for cooperation across sectors, scales and administrations and strong continuous public and political support. All reactions to the statements were positive to a greater or lesser extent.

Table 5.3.2 Survey outcomes

	Delflandse kust	**Flaauwe Werk**	**Kop van Voorne**	**Noordwijk/ Katwijk**	**West-Zeeuws Vlaanderen**	**Average**
An *undesirable situation* is important for the success of the project	5	4	5	4	4	4,4
A *long-term perspective* is important for the success of the project	5	4	5	5	5	4,8
A *sense of urgency* is important for the success of the project	5	5	5	5	5	5
Participation of stakeholders is important for the success of the project	5	4	5	5	5	4,8
Cooperation between stakeholders is important for the success of the project	4	4	5	5	4	4,4
Cooperation across sectors, scales and administrations is important for the success of the project	5	3	5	5	5	4,6
A *clear division of responsibilities* is important for the success of the project	5	5	5	5	4	4,8
The *availability of financial and personal means and resources* is important for the success of the project	5	4	5	5	4	4,6
Strong continuous public and political support is important for the success of the project	5	3	5	4	4	4,2
Long-term financial commitment is important for the success of the project	4	3	5	4	4	4
A *political person who leads the project with dedication* is important for the success of the project	5	4	5	5	4	4,6

1: Completely disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Completely agree.

The fact that the project managers of these five Weak Links responded positively to the statements on the success conditions for coastal management projects can be seen as a confirmation of the identified success conditions of the two case studies of Southwest Walcheren and the Sand Engine.

5.4 Case study comparison: Sand Engine vs. Southwest Walcheren

The data of the two case studies and the survey are compared to the theoretical success conditions list, which will show which conditions actually help along coastal management. This will lead to a final list of conditions that must be present to enhance the feasibility of the development of a more resilient coastal zone.

When looking at the result of the Sand Engine there are 12 conditions which are valued by more than half of the stakeholders and another three which are considered to be essential for the project to succeed. These essential conditions are public and political support, the availability of financial and personal means and resources and leadership and dedication. This last condition is not part of the theoretical framework, but was mentioned so often and clearly that it should be added to the list. The other conditions that are important for the success of the Sand Engine project are:

- Long-term perspective
- Stakeholder participation
- Stakeholder cooperation across sectors, scales and administrations
- Clear division of responsibilities
- Long-term financial commitment
- Mechanisms for monitoring
- Small and intermediate steps in the process
- Coastal zone copes with change
- Coastal zone recovers to original state
- Use of natural dynamics
- Trend towards more sustainable use and added ecological value of coastal zone
- Improved protections and sustainable use of coastal zone
- Development and export of (specialised) knowledge
- Spill over of policy integration and multi-level governance

The coastal projects of Southwest Walcheren of the Weak Links programme show a similar but somewhat different outcome. Here 13 success conditions were pointed out by more than half of the five stakeholders as being important for the success of the project. These are availability of financial and personal means and resources and leadership and dedication. Again this new condition comes up in the results and is mentioned by the stakeholders frequently. The other success conditions that were considered important are:

- Undesirable situation
- Long-term perspective
- Public and political support
- Stakeholder participation
- Stakeholder cooperation across sectors, scales and administrations
- Long-term financial commitment
- Mechanisms for monitoring, evaluation and reviewing
- Planning for implementation, data collection, decision making and management
- Results of the process can be formalized with existing legal instruments
- Small and intermediate steps in process

- Trends towards more sustainable use and added ecological value of the coastal zone
- Improved protections and sustainable use of coastal zone
- Development and export of (specialised) knowledge
- Spill over of policy integration and multi-level governance

Table 5.4 Importance of presence of success conditions per case study

	Sand Engine	Southwest Walcheren	Conditions in common
Undesirable situation		+	
Sense of urgency			
Long-term perspective	+	+	+
Public and political support	++	+	++
Stakeholder participation	+	+	+
Stakeholder cooperation across sectors, scales & administrations	+	+	+
Clear division of responsibilities	+		
Long-term financial commitment	+	+	+
Financial and personal means and resources available	++	++	++
Mechanisms for monitoring, evaluation and reviewing	+	+	+
Planning for implementation, data collection, decision making and management		+	
Transparent and clear documentation and access to information			
Results can be formalized legally		+	
Small and intermediate steps in process	+	+	+
Dedicated neutral and skilled process manager			
Coastal zone copes with changes	+		
Coastal zone recovers to original state	+		
Coastal zone adapts to new situation			
Ecosystem-based approach			
Use of natural dynamics	+		
Trend towards more sustainable use & added ecological value of coastal zone	+	+	+
Improved protections and sustainable use of coastal zone	+	+	+
Development and export of knowledge	+	+	+
Spill over of policy integration & multi-level governance	+	+	+
Leadership and dedication	++	++	++

When comparing the two case studies it can be noticed that the essential success conditions are practically the same; availability of financial and personal means and resources and leadership and dedication are shared by the two cases. Only the Sand Engine has one additional essential success condition which is public and political support. This can be explained by the fact that the Weak Links projects are set up due to necessity as the coastline needed updating to be safe. However, the Sand Engine project was not a necessary project as coastal safety had already been restored at the coast of South-Holland. This created a different situation. The public and politicians had to be convinced properly for the Sand Engine project, as acute absence of coastal

safety was not an issue here. That is why public and political support was considered more important by the stakeholders.

There are ten other conditions which are valued by stakeholders of both case studies. These are a long-term perspective; stakeholder participation; stakeholder cooperation across sectors, scales and administrations; long-term financial commitment; mechanisms for monitoring, evaluation and reviewing; small and intermediate steps in the process; a trend towards more sustainable use and added ecological value of the coastal zone; improved protections and sustainable use of the coastal zone; development and export of (specialised) knowledge; and spill over of policy integration and multi-level governance. As these success conditions are valued in both cases, this means that the presence of these conditions is important for the success of the coastal projects.

There are also a number of conditions which are only valued in one of the case studies as important. For the Sand Engine these are a clear division of responsibilities; a coastal zone that copes with changes; a coastal zone that recovers to its original state; and the use of natural dynamics. For Southwest Walcheren these are an undesirable situation; planning for implementation, data collection, decision making and management; and legal formalization of the results. Finally, there are some conditions which were not valued as important conditions in neither of the case studies. These were a sense of urgency; transparent and clear documentation and access to information; a dedicated neutral and skilled process manager; a coastal zone which adapts to new situations; and an ecosystem-based approach. In the survey five project managers of other coastal projects confirmed the importance of these success conditions, which implies that the results of the case studies could be relevant on a broader scale, at least in the Dutch context of coastal management.

Dunes between Westkapelle and Domburg

5.5 Conclusion: a new conditions list

After comparing the two case studies and the survey, a new list of success conditions was made. These conditions are all valued as important in both case studies by more than half of the stakeholders and also include the conditions which were marked as essential to the success of the coastal projects of the Sand Engine and Southwest Walcheren. The list of conditions that must be present to enhance the feasibility of the development of a more resilient coastal zone includes the following:

Societal context conditions

- There is a coastal management approach and plans have a long-term perspective.
- The coastal zone project has strong and continuous public and political support.

Stakeholder conditions

- Stakeholders are involved and can participate in the decision making process.
- There is cooperation across sectors, scales and administrations.

Financial conditions

- Financial and personal means and resources are available to the project team.
- There is a long-term financial commitment by the stakeholders.

Process/planning conditions

- There are mechanisms for monitoring, evaluation and reviewing.
- The process has small and intermediate steps.

Coastal zone conditions

- Monitoring shows a demonstrable trend towards a more sustainable use of coastal and marine resources and added ecological value.
- There is improved protection and sustainable use of the coastal zone.

Knowledge conditions

- There is development and export of (specialised) knowledge.
- There is spill over of policy integration and multi-level governance to other sectors and levels.

Newly added condition

- There is dedicated leadership by a (political) representative.

6. Discussion

In chapter five practice was compared to theory by researching two case studies on success conditions for coastal management for more resilient coastal zones. The final refined list of success conditions can be found in 6.1. These results are then compared to other recent research on Integrated Coastal Zone Management, Building with Nature and ecosystem-bases damming projects. This could show whether the findings of this research are in line with others or whether this may be a case on its own.

6.1 Refined list of success conditions

Comparison of the finding of the two case studies of the Sand Engine and Southwest Walcheren resulted in a refined list of conditions that enhance the feasibility of the development of a more resilient coastal zone. The chance that coastal management successfully contributes to more resilient coastal zones is higher is the following conditions are present:

Societal context conditions
- There is a coastal management approach and plans have a long-term perspective.
- The coastal zone project has strong and continuous public and political support.

Stakeholder conditions
- Stakeholders are involved and can participate in the decision making process.
- There is cooperation across sectors, scales and administrations.

Financial conditions
- Financial and personal means and resources are available to the project team.
- There is a long-term financial commitment by the stakeholders.

Process/planning conditions
- There are mechanisms for monitoring, evaluation and reviewing.
- The process has small and intermediate steps.

Coastal zone conditions
- Monitoring shows a demonstrable trend towards a more sustainable use of coastal and marine resources and added ecological value.
- There is improved protection and sustainable use of the coastal zone.

Knowledge conditions
- There is development and export of (specialised) knowledge.
- There is spill over of policy integration and multi-level governance to other sectors and levels.

Newly added condition
- There is dedicated leadership by a (political) representative.

6.2 Latest research

The new list of success conditions shows some similarities with results of other recent research. Ernoul & Wardell-Johnson (2013) examined governance in Integrated Coastal Zone Management (ICZM) through social network analysis and compared two Mediterranean deltas in France and Turkey. Their focus is on vertical and horizontal integration, two nodes of collaboration among stakeholders. Vertical integration is the communication among political levels, horizontal integration shows the interaction between different sectors of the same administrative and social levels. The authors emphasize the importance of a collaborative approach in which local knowledge, control and context are integrated. Their analysis shows the dynamics of power and interactions between interest and actors. They stress the importance of the engagement of civil society. Cooperation and stakeholder involvement are important as ''the lack of consensus and participation within social networks collaborating in ICZM could result in systemic vulnerability reducing resilience and adaptive capacity of both ecological and social systems' (Ernoul & Wardell-Johnson, 2013, p.2). This corresponds with the findings of this research, in which stakeholder participation and cooperation across sectors, scales and administrations are considered as being important as well. Also 'the disparity in funding opportunities between the two sites has a potential for direct impact on the governance networks, limiting cross-scale collaborations and inclusive participatory processes' (Ernoul & Wardell-Johnson, 2013, p. 8), which resembles the financial means and commitment necessary for success of a coastal project. 'However, given the differences in stakeholder types, power structures and civil society, the third component of ICZM, namely participation, requires individual approaches to better fit the specific governance context' (Ernoul & Wardell-Johnson, 2013, p. 8). This implies that each coastal project needs to be adjusted to its own local political and social context and that standardized approaches might not be the best path towards success.

Another research has been done by Van Weesenbeeck et al. (2014) on the Melbourne Channel Deepening project. This research is an analysis of the development from a conventional state-led project to a Building with Nature (BnW) arrangement. Building with Nature is the approach which is also used with the Sand Engine in the Netherlands. 'The focus is on what conditions enabled a BnW approach in this project and how this changed the project design' (Van Weesenbeeck et al., 2014, p. 3). This particular case in Melbourne shows many similarities to the two cases of this research. After failing to get approval for the first conventional plan to deepen the channel, a new approach was used. In the first attempt a couple of issues troubled the progress, such as miscommunication, a lack of information, a strained budget, planning, coherence and the level of the requirements for the approval. With the Building with Nature approach new practices where introduced to the project. There was an early involvement of both ecological and social dynamics. A wide range of stakeholders was present from the initiation phase onwards. Furthermore, there was a better availability of resources, also financial; there were more staff members assigned to the project; representation of stakeholders was better organised and included NGOs, local governments, industrial parties and dredgers. Furthermore, a new partnership was created which involved scientist and consultants who were able to create a better ecological design using the BnW principles. Communication towards the community was improved and the public was able to participate and influence the process of the project. Lastly, they also installed a 'real-life' monitoring programme, with inclusion of ecological dynamics (Van Weesenbeeck et al., 2014). This resembles a number of conditions that were identified here as important such as availability of financial and personal

means and resources; stakeholder participation; stakeholder cooperation across sectors, scales and administrations; mechanisms for monitoring, evaluation and review; and sustainable use and added ecological value of the coastal zone. Another observation was made by Van Weesenbeeck et al. (2014), namely that political and societal support are necessary for such large projects. Plurality of stakeholders can increase complexity, but inclusion of stakeholders can also enhance support. 'A preconditions hereof is political support, as a crucial resource of develop and construct marine infrastructure' (Van Weesenbeeck et al., 2014, p. 12). These results support the findings of this research in respect to the condition of public and political support, which was marked as an essential condition by the stakeholders of the case studies of the Sand Engine and Southwest Walcheren.

Korbee et al. (2014) have focused their research on the damming of deltas and estuaries and attempt to integrate ecosystem-based flood risks reduction measures in the standard suite of flood risk management solutions. Their main example is the Delta works in the Netherlands, which, in its rigidity to protect the people, failed to include the functioning of the ecosystem and the sediment fluxes. Therefore, they advocate innovative approaches that integrate coastal safety with ecosystem services. For this they suggest the adaptive delta management approach which entails flexible measures, measurable targets, monitoring and intervention. Such measures are sand nourishment which enhances natural dune formation, a mechanism which is also used at the Sand Engine. However, these nature-based defences are not ready to use tools for decision makers and coastal managers. To achieve this more is needed, such as a monitoring strategy, clear targets and goals, assessment of the monitoring data, a clear management plan and a long-term financial plan. These conditions have also come up as important in this research. However, to achieve successful coastal management the ecological engineering and management aspect will have to be combined as 'the main challenge for managing sandy coastlines will be to optimize biodiversity by allowing natural dynamic processes while maintaining reasonable safety levels and keeping costs flexible' (Korbee, 2014, p. 2). To achieve this some flexibility is necessary in both the management aspects and the physical solutions. Path dependency is an important concept as future solutions need to be able to fit in easily with the already existing infrastructure. This calls for low-regret measures which can be easily adapted. That way the risk of over- or underinvestment in coastal defence solutions can be reduced, as is also proclaimed in the Delta Program (Deltaprogramma Kust, 2013). 'Only a more adaptive form of management, which allows for monitoring and a learning-by-doing approach, will enable us to deal with the dynamic and more unpredictable nature of ecosystems and, thus, with a more dynamic and uncertain future' (Korbee et al., 2014, p.6). Again, a couple of conditions return in the research of Korbee et al. (2014), such as monitoring programmes, long-term financial commitment, and a clear management plan. Also more sustainable use and added ecological value of the coastal zone are important in this research and are integrated in the management approach.

These three research papers show many similarities with this research on success conditions. This could mean that the case studies might not be exceptions and that the identified conditions may be applicable to more coastal zone projects.

6.3 Limitations

The results of this research seem to be unambiguous and coherent with other recent research. However, one needs to keep in mind that this is a qualitative research focusing its attending to only case studies. Moreover, one of these case studies, the Sand Engine, is still a rarity in coastal management and can therefore not easily be generalized. However, these case studies can be added to a whole array of individual case studies which focus on similar conditions and contribute to a broader view. This could be a next step in this field of research, to collect such case studies and compare their results for more generalized findings.

Also the survey has some drawbacks as it was a small population to start with and an even lower response level. On the one hand, this calls into question how much verification this survey can provide for the results of the case studies. On the other hand, the results of the survey were consistent and confirmed the findings of the case studies. However, to be able to make more generalized statements a quantitative survey would have to be carried out among many similar coastal projects. This group is simply too small to make any well-supported statements.

Another limitation of this research is the fact that it only deals with Dutch coastal management projects. This means that only the Dutch context is represented here, in both societal and administrative ways. Dutch government administration are quite well organised but also have to answer for much jurisdiction. This can limit the creativity of policy makers as they have to work within certain frameworks. However, the upcoming of the adaptive management discourse could change this and result in a more flexible policy making environment. Yet, it may take many years before all levels and sectors have internalised such practice.

Keeping these limitations in mind, this research can add to the international discipline of coastal management, but it cannot be extrapolated to every other coastal situation.

7. Conclusion

7.1 Research question

In this research an attempt has been made to add knowledge to the discipline of coastal management. This project has specifically focused on resilient coastal zones and what specific conditions could enhance the feasibility of the development of coastal zone projects which incorporate resilience in their approach. Such approaches include Integrated Coastal Zone Management and Building with Nature. An exploration of this field of research showed a knowledge gap on the combining of theoretical frameworks and findings in practice. To reduce this knowledge gap this research project has been carried out. This research aimed to provide insights on conditions which could enhance the feasibility of the development of a more resilient coastal zone. This led to the following research question:

Which management-related conditions make resilient coastal zones feasible?

To answer this research question first a theoretical framework was made and several sub questions were answered. First of all: *What is a resilient coastal zone?* But also: *Which management conditions can improve coastal zone management?* The answers to these questions provide knowledge to continue to another set of questions: *Which conditions contribute in theory to a more resilient coastal zone?* And: *Which conditions have contributed to resilient coastal zones in practice?* The answering of these questions would provide an answer to the main research question. This has been done by combining theoretical success conditions for coastal management with the practice of two case studies along the Dutch coastline. By interviewing stakeholders of the coastal projects insight was gained on the presence and the importance of conditions which could possibly enhance the feasibility of the development of a more resilient coastal zone in these specific locations. The case studies were conducted for the Sand Engine near The Hague and the Weak Link in Southwest Walcheren in Zeeland. To verify the results of the case studies a survey was also conducted among other Weak Link projects along the Dutch coastline.

7.2 Management-related conditions for a more resilient coastal zone

Comparing theory to practice led to the following conclusions. Most of the theoretical conditions were confirmed by the practice in the case studies. However, some of the conditions were not marked as important for the development of a resilient coastal zone. Noteworthy is the fact that one key condition was not identified in the theoretical framework, namely dedicated leadership. This condition was named by almost all stakeholders of both case studies and was therefore added to the refined list of success conditions. The chance that coastal management successfully contributes to more resilient coastal zones is higher is the following conditions are present:

Societal context conditions

There is a coastal management approach and plans have a long-term perspective.
The coastal zone project has strong and continuous public and political support.

Stakeholder conditions
Stakeholders are involved and can participate in the decision making process.
There is cooperation across sectors, scales and administrations.

Financial conditions
Financial and personal means and resources are available to the project team.
There is a long-term financial commitment by the stakeholders.

Process/planning conditions
There are mechanisms for monitoring, evaluation and reviewing.
The process has small and intermediate steps.

Coastal zone conditions
Monitoring shows a demonstrable trend towards a more sustainable use of coastal and marine resources and added ecological value.
There is improved protection and sustainable use of the coastal zone.

Knowledge conditions
There is development and export of (specialised) knowledge.
There is spill over of policy integration and multi-level governance to other sectors and levels.

Newly added condition
There is dedicated leadership by a (political) representative.

A distinction has to be made between some conditions which were regarded as essential by the stakeholders and other conditions which were important for the coastal projects but not vital for the project to succeed. These essential conditions are strong and continuous public and political support; the availability of financial and personal means and resources; and dedicated leadership. These three conditions would have to be fulfilled for the success of the development of a more resilient coastal zone.

7.3 Recommendations

The findings in this research can be useful for policy makers and coastal managers. When knowing which conditions can help improve the management and thus the development of resilient coastal zones, this can be a great advantage. This list can be applied to coastal management projects and point out which conditions need improvement and investment. This could enhance the effectiveness of coastal zone management.

7.4 Further research

The findings of this research are based on two case studies, meaning that the conclusions of this thesis cannot be properly used to make generalizations on this topic. However, further research can build on these findings and use them as a template for more quantitative research to backup these findings properly. For example, the survey could be carried out on a much larger scale to provide insights on conditions for successful coastal management of more resilient coastal zones on a broader basis. This could apply to both the Dutch context as the international field of coastal management.

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Interviews

Interview Ben Girwar, Koen Oome & Willem Rietbroek, Projectbureau de Zandmotor, Provincie Zuid-Holland, 26-02-2014, Den Haag.

Interview Leo Linnartz, Arke Natuur/WereldNatuurFonds, 06-03-2014, Kijkduin (Den Haag).

Interview Arie van Blanken, Gemeente Westland, 17-03-2014, 's Gravenzande.

Interview Wim de Vries, Ministerie van Infrastructuur en Milieu, afdeling Waterveiligheid, 02-04-2014, Den Haag.

Interview Niels Al, Gemeente Den Haag, 02-04-2014, Den Haag.

Interview Stefan Aarninkhof, Ecoshape, 04-04-2014, telefonisch.

Interview Arjen Boon, Deltares, 07-04-2014, Delft.

Interview Lies Dekker, Provincie Zeeland, 08-04-2014, Ritthem.

Interview Andre Marinisse, Waterschap Scheldestromen, 08-04-2014, Middelburg.

Interview Walter Vael, Gemeente Vlissingen, 16-04-2014, Vlissingen.

Interview Sjacky Vasseur, Gemeente Veere, 17-04-2014, Domburg.

Interview Prof. Dr. Ronald Waterman, 18-04-2014, Delft.

Interview Bart Kornman, Ministerie van Infrastructuur en Milieu, afdeling Waterveiligheid, 25-04-2014, Den Haag.

Appendices

A. Survey

B. Transcripts interviews

A. Survey

In het kader van mijn Masterscriptie over succesfactoren in kustprojecten aan de Universiteit Utrecht doe ik onderzoek naar de Zwakke Schakels aan de Nederlandse kust. De focus ligt hierbij op de procesmatige condities die een kustproject zoals de Schakels laten slagen. Daarom zou ik graag uw input als projectleider/betrokkene hierover willen hebben. In de link vind u een korte enquête over een aantal factoren die van belang kunnen zijn bij succesvolle kustprojecten. Zou u de enquête in willen vullen voor de Zwakke Schakel …. ? De enquête duurt ongeveer 5 minuten. Alvast bedankt!

http://www.thesistools.com/web/?id=400940

Bij welke Zwakke Schakel bent/was u betrokken?
Wat is/was uw functie bij de Zwakke Schakel?

1. Een ongewenste kustsituatie is belangrijk voor het slagen van het Zwakke Schakel project.

2. Een lange termijn perspectief is belangrijk voor het slagen van het Zwakke Schakel project.

3. Een gevoel van urgentie is belangrijk voor het slagen van het Zwakke Schakel project.

4. Participatie van belanghebbenden is belangrijk voor het slagen van het Zwakke Schakel project.

5. Samenwerking tussen belanghebbenden en ontwikkelaars is belangrijk voor het slagen van het Zwakke Schakel project.

6. Samenwerking tussen sectoren, schaalniveaus en overheden is belangrijk voor het slagen van het Zwakke Schakel project.

7. Een duidelijke verdeling van verantwoordelijkheden is belangrijk voor het slagen van het Zwakke Schakel project.

8. De aanwezigheid van financiële en persoonlijke middelen is belangrijk voor het slagen van het Zwakke Schakel project.

9. Sterke, continue publieke en politieke steun zijn belangrijk voor het slagen van het Zwakke Schakel project.

10. Financiële steun op de lange termijn is belangrijk voor het slagen van het Zwakke Schakel project.

11. Een persoon die politiek/ambtelijk het project trekt is belangrijk voor het slagen van het Zwakke Schakel project.

B. Transcripts Interviews

Interview Ben Girwar, Koen Oome & Willem Rietbroek, Provincie Zuid-Holland

Interview Leo Linnartz, Arke Natuur/WereldNatuurFonds

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